PUBLIC WORKS

CITY COUNTY STATE

APRIL 15, 1922

VOL. 52 NO. 15

Entered as second-class matter at the Post Office, at New York, N. Y., November 22, 1921, under the Act of March 3, 1879.
Published weekly by **PUBLIC WORKS JOURNAL CORPORATION**, 243 West 39th Street, New York, N. Y.
Subscription price $3.00 a year, single copies 10 cents.

PUBLIC WORKS.

CITY COUNTY STATE

A Combination of "MUNICIPAL JOURNAL" and "CONTRACTING"

Vol. 52 April 15, 1922 No. 15

Construction of Franklin Highway

By E. H. Sauerman*

Nearly ten miles of heavy grading and concrete surface, 60,000 yards of rock, boulders and earth handled by steam shovel and scrapers, hauled by tractors. Concrete materials delivered in batch boxes on industrial track from central storage. Aggregate trains hauled up steep grades by tractors. Side-hill platform storage for 3400 yards of stone and sand. Special brakes and safety drags.

The Pennsylvania State Highway between Franklin and Pearl in Venango county is an entirely new construction, 50,024 feet long, through heavy mountainous country, partly following the location of the old country roads and partly in new locations that involve some heavy grading, requiring about 60,000 yards of excavation that was chiefly done with steam shovel and tractor-hauled scrapers.

The section, officially known as "Route 233 Venango County," was built by the Pennsylvania State Highway Construction Bureau, the contracts being regularly inspected under the general direction and supervision of the Highway Department, Col. W. D. Uhler, chief engineer, and Paul Tells, chief of construction.

The excavated material was chiefly sandy loam and large boulders up to about 1,000 tons. A careful preliminary survey of the work convinced the Highway Department that many of the heavy boulders could be shot down the slopes at comparatively small expense, an assumption which was subsequently justified and meant a much smaller price for moving them than had been figured on by the contractors, who planned to break them up thoroughly and carry them away piecemeal.

* Formerly general superintendent for the Pennsylvania State Highway Department; now connected with the MacArthur Concrete Pile and Foundation Company.

HEAVY EXCAVATION

About 17,000 feet of the road is revision work. much of it through heavily wooded territory, where the grading was preceded by a 4-man axe gang chopping down all the timber, cutting it into 20-foot lengths and piling it alongside the right of way, where it became the property of the adjacent owners. The brush was burned and the stumps and roots were removed to a depth of one foot below subgrade, an operation easily and rapidly accomplished by the 10-ton tractors, which were con-

VERY LARGE BOULDER BEFORE BLASTING.

EFFECT OF DRILLING AND BLASTING SAME LARGE BOULDER.

nected to them with heavy chains eccentrically hitched so that the pull also twisted the stump. All the stumps were thus pulled out and hauled away to be burned.

The 60,000 yards of excavation included 5,300 yards of rock and was about one-half steam shovel work. The steam shovel had a special ¾-yard bucket with a manganese steel front and Panama teeth. It was extra wide and handled large boulders efficiently. It made about 25,000 yards of excavation and disposed of a large proportion of the waste material by side casting. Special pains were taken to complete the slope work with the steam shovel which trimmed it thoroughly and carefully at the probable expense of a few yards of daily output, which, however, was more than compensated by avoiding a return trip or costly hand labor. Two men with bars were kept working on the top of the slope, rolling all loose materials down to within reach of the shovel. In the Pecan Siding cut, 28 feet deep and 600 feet long, about 6,000 yards of heavy boulders and earth were removed in three weeks by one steam shovel and a 25-man gang. The boulders were block drilled and blasted and about one-half of the excavated material was side cast on the downhill slope, filling out about one-quarter of the width of the roadway. The remainder of the excavated material was loaded directly by the steam shovel into 1-yard dump wagons hauled an average distance of about 600 feet by six teams.

In this cut an 800-ton boulder was found projecting far into the right-of-way on the uphill side and the overhanging portion was removed by drilling six 8-foot holes across the boulder near the upper end and firing in them a charge of about 60 pounds of 40 per cent dynamite which shattered the soft sandstone so that the fragments that did not roll down the slope were easily handled by the steam shovel. The drilling was done with two Ingersoll-Rand DCR-13 Jackhammers, operated with air compressed by a portable gasoline machine with a capacity of 210 cubic feet of free air per minute.

Most of the rock encountered was sandstone varying from hard to soft, and was used for fills, but not for concrete aggregate, the latter being imported.

STEAM SHOVEL WORK

The steam shovel was supplied with water under gravity pressure through lines of 2-inch pipe up to 6,000 feet long wherever it was practicable to tap an elevated spring. On grades the shovel invariably worked upgrade in order to secure automatic drainage, but when operating on level ground where no gravity supply was available, the water was delivered to the steam shovel boiler by a domestic gasoline driven pump, mounted on wheels and installed at convenient springs, not more than 9,000 feet from the shovel.

In all the steam shovel work special attention was given to the slopes adjacent to culverts and bridges, where the slopes were made longer and wider so as to be certain to remove abundance of earth and avoid the possibility of having to return with men and wheelbarrows to do additional work at a much higher cost.

SCRAPER GRADING

Wherever the construction was along the old alignment, the excavation was done almost entirely without the steam shovel, the surface first being loosened with a heavy Western rooter plow and a heavy moldboard plow, both hauled by tractors, and followed by Baker-Maney scrapers hauled tandem in sets of three by each of two 10-ton tractors, making units that often handled from 150 to 200 yards a day, notwithstanding large boulders that considerably delayed operations. A rock cut of sandstone 4 feet deep was drilled, blasted and then removed by the Baker-Maney scrapers.

The scrapers of 1-yard capacity were easily filled and were attached to each other with special spring bumpers and short tongues so that no difficulty was encountered other than that due to the fact that in hauling over rough ground the jarring would sometimes accidentally dump a load, causing obstructions often liable to tear the train apart and making it necessary to place a man on each scraper to watch and control them.

FINISHING SUBGRADE

In cuts the steam shovel excavated a few inches below the required level so as to leave the surface not more than about one inch below subgrade. The forms were then set and after they had been carefully leveled, enough earth was thrown in between them from the shoulders to fill up slightly above subgrade elevation and was thoroughly rolled with the steam roller and finally finished with a Lakewood machine hauled behind the roller operated at about ¾ speed. In earth, clay or gravel this subgrader would cut 2 inches deep, but where soft shale or other hard material was encountered, it was first loosened by the scarifier attached to the steam roller, after which the grading machine was operated successfully to bring it within ⅛ inch of the required elevation, thus producing a very smooth, compact, uniform surface that was appreciated by the engineers and was economical in that it secured the exact amount of expensive concrete required for the hard surface. One steam roller was constantly operated behind the steam shovel, one behind the Baker-Maney scrapers and another was used for the fine grading.

Operations were conducted from Pecan siding, about midway between the two ends of the job, where there were established repair shops, office and commissary for labor and where plant and material were delivered by the railroad. The Pennsylvania State Highway Commission acquired an old hotel at Pecan siding and equipped it with bunks and commissaries, providing accommodations for about 75 men, the remainder boarding or living in the locality.

AGGREGATE STORAGE

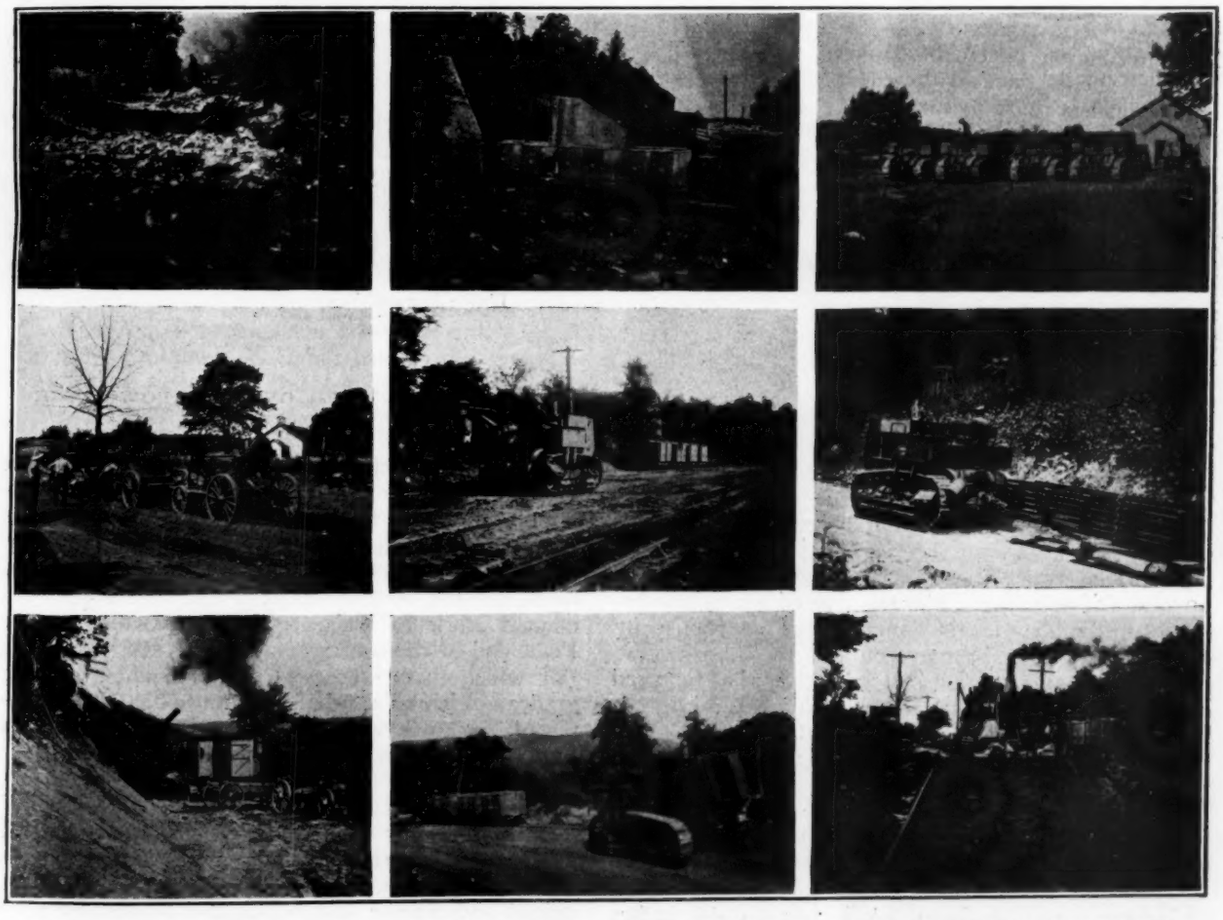
The development of the facilities and operating arrangements at Pecan siding were made to conform to the topography and take advantage of the natural features of the valley and hillside. The siding of the railroad track was paralleled by a river 60 feet away and about 20 feet below it, that permitted the advantageous construction of a gravity storage plant and service track. The siding, which served as a material track, was paralleled by a standard gage track on which a locomotive crane, equipped with a clamshell bucket, was operated to unload gondola cars direct and to handle the aggregate dumped from "battleships," or large bottom-dump steel gondolas.

to a storage pile established on a timber platform 40 feet wide and 200 feet long floored with longitudinal deck planks laid on 12 x 12-inch transverse timbers which at one end rested on the beveled surface of the ground adjacent to the track and at the other end projected over the side-hill slope and were supported there on vertical posts, between which there were two lines of industrial tracks parallel to the crane track and siding. This platform had a capacity of 2,000 tons of broken stone and 1,400 tons of sand, which was retained by a longitudinal wall 2 feet high on the side nearest the crane track and by a similar wall 6 feet high on the opposite side, which was braced by diagonal tension rods running through the storage pile. The lower platform was made with heavy beams resting on the tops of the vertical posts and scabbed to them with 2-inch planks spiked to the posts only, and thus providing for easy disassembling, when the heavy timber will be uninjured and will yield 100 per cent salvage. About 45,000 feet b.m. of long-leaf yellow pine was required for the bin and platform.

There were set in the floor of the platform, over the two industrial tracks, twenty 12 x 12-inch openings, eight for sand and twelve for stone, that were closed by cast iron gates, operating in steel slides and easily handled from below by the trainmen, who can load a batch box in about 10 seconds. The average time for loading a trainload of 8 batch boxes with both sand and broken stone was two minutes. The cars were handled under the storage floor by a 3-ton Whitcomb gasoline locomotive that hauled them to an adjacent shed, where the required amount of 5 bags of cement was emptied into each batch box by hand, completing the loading of the train in about four minutes after the time when it was first delivered under the storage bin.

CEMENT STORAGE

The cement house, located between a railroad siding and the industrial tracks, was about 66 feet long and 30 feet wide, with a capacity for 11 carloads of cement. The floor was made with two cross layers of 1-inch boards with tar paper between the layers. The walls were made of ⅞-inch, square edge horizontal boards covered with battened tar paper. The roof boards were covered with 3-ply roofing felt, and the house was perfectly weatherproof. Before concreting was commenced, the storehouse was filled to capacity with cement in bags, which were piled so



HANDLING BOULDERS IN REVISION WORK.
10-TON TRACTOR HAULING THREE SCRAPERS.
SHOVEL FINISHING EXTRA WIDE SLOPE.

3-TON SHIFTING LOCOMOTIVE HAULING TRAIN OUT OF LOADING YARD.
TRACTOR IDLING DOWN 9 PER CENT. GRADE WITH TRAIN OF EMPTIES.
TRACTOR HAULING LOADED TRAIN UP LONG 9 PER CENT. GRADE.

FLEET OF TRACTORS FOR HAULING TRAINS ON HEAVY GRADES.
TRACTOR SKIDDING 25-POUND, 30-FOOT RAILS UP HILL.
FINISHING SURFACE FOR CONCRETE WITH SUB-GRADE MACHINE.

as to form independent walls adjacent to the sides of the building and thus prevent undue pressure against the latter. The space between these bag walls was filled with cement bags laid parallel to three transverse passageways, each 10-feet wide, that extended across the full width of the building and were left open to provide communication between to provide for loading and unloading with free communication between three large opposite doors on each of the long sides of the building, that opened respectively on the railroad siding and on the industrial tracks.

In each of these passages there was installed a Mathews gravity roller conveyor, which rapidly delivered the bags from the cars to storage, to batch box trains, or from storage to the outside loading platform where the batch boxes were filled. The conveyors were used as much as possible for transferring cement directly from the railroad cars to the batch boxes, thus avoiding rehandling and maintaining maximum storage so that at the end of the first season probably more than one-half of the cement originally stored in the house still remained there in reserve; which reserve, however, was used before the season closed.

CONCRETING

The concrete pavement 20 feet wide, 6 inches thick at the edges and 8 inches thick in the center, was made with 1:2:3 mixture, having three bags of cement, 600 pounds of sand and 1,000 pounds of ⅝ to 2¾-inch stone and 112 pounds of reinforcement per linear foot. The reinforcement consisted of 56 pounds National mesh fabric received in sheets 52 inches wide and 17 feet 8 inches long that were laid transversely across the road with an overlap of 4 inches. The position of the reinforcement in the body of the concrete was determined by laying the latter in two courses, the first course screeded to an elevation 2 inches below that required for the finished surface, after which the reinforcement was quickly laid and immediately covered with the finishing course applied within a few minutes after the bottom course so that both courses structurally formed a single monolithic course with the reinforcement imbedded in it in a substantially single continuous operation.

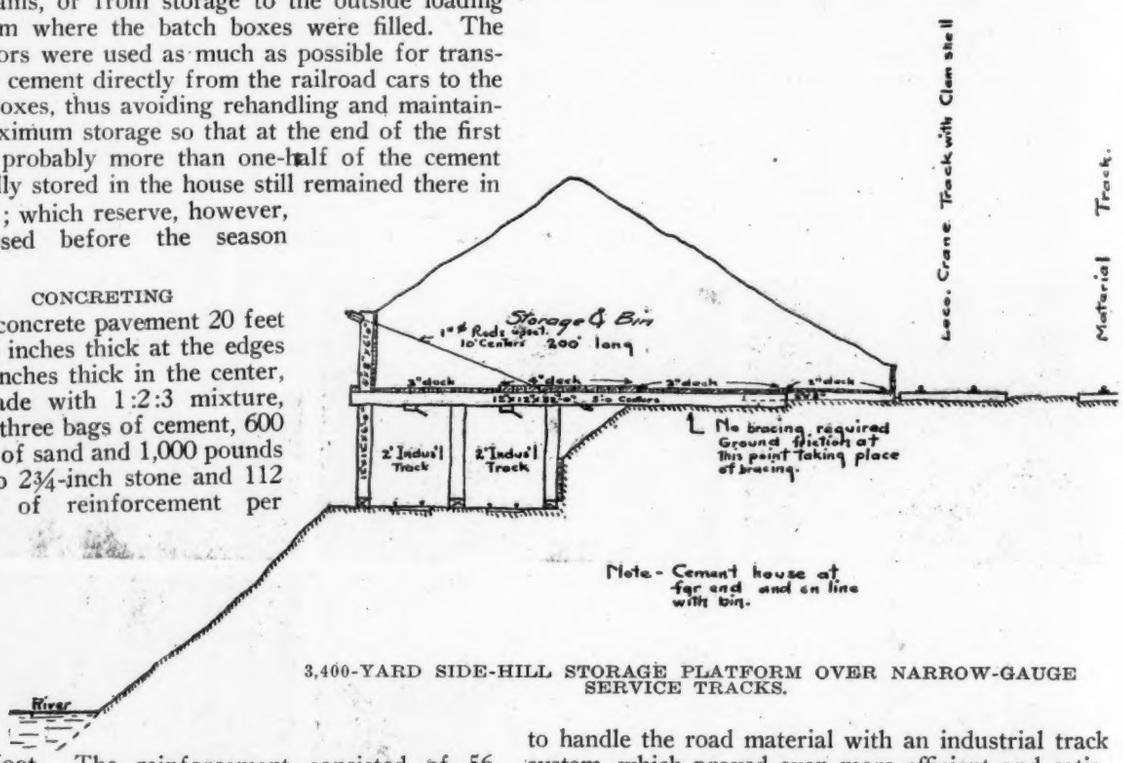
The culverts were all made of precast reinforced concrete pipe of from 14 inches to 48 inches diameter, made by the Musselman Company and laid with their ends set in concrete face walls which were built by the paver when it laid the concrete surface. The single concrete arch bridge of 10 feet span was built by the paver at the end of a season after it had finished road surfacing.

Concreting operations were commenced with the paver located about 8,000 feet from the Pecan siding, whence it advanced about 3½ miles to the Pearl end of the contract and then returned to the place of beginning and worked first upgrade, and continued in the same direction until operations were suspended for the winter with the expectation of reaching the opposite end of the contract, at Franklin, during the present season.

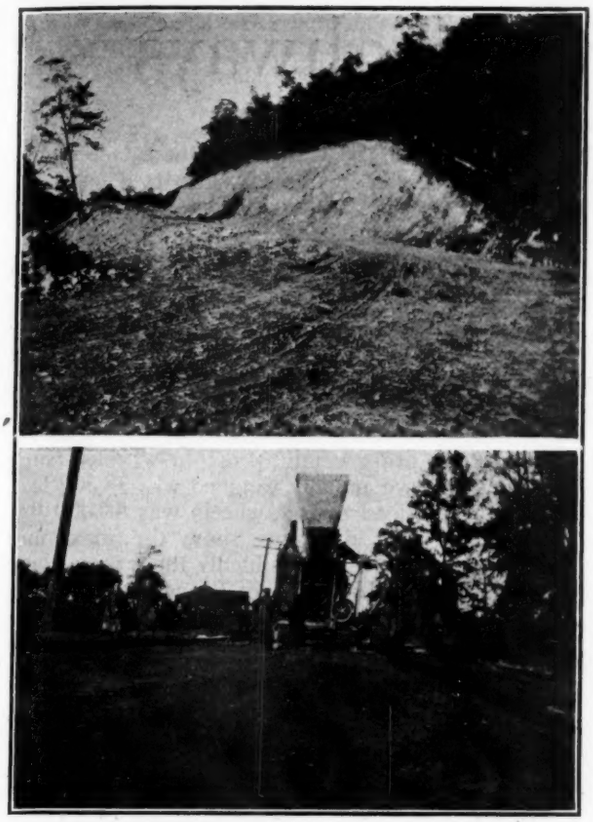
DISTRIBUTION OF AGGREGATE

Notwithstanding that the alignment includes a 6 per cent grade 7,000 feet long, another 6 per cent grade 8,400 feet long and a 9 per cent grade 9,000 feet long with many curves in it, it was determined to handle the road material with an industrial track system, which proved even more efficient and satisfactory than was anticipated. The whole ten miles of the contract was served by an equipment of about 7 miles of 24-inch industrial track, with steel ties made by the Arthur Koppel Co. This provided enough track to reach from Pecan siding to the Pearl end of the contract, lay the necessary switches (of which there were eight) and double-track the grades. After this end of the contract had been completed, the track was removed and laid from Pecan to the Franklin end, thus serving the entire work.

The track was made up of 25-pound rails in 30-foot lengths, with steel cross ties and clips, assembled by the contractor in the field. When it was shifted as the work progressed, half a dozen or more lengths of track were neatly piled up and bundled together, placed on a timber skid and hauled to the new position by a tractor, thus saving considerable time and labor. The stiffness of the 25-pound rails and their length of 30 feet, eliminating many joints, produced an unusually rigid and satisfactory track that is recommended by the superintendent for similar service.



3,400-YARD SIDE-HILL STORAGE PLATFORM OVER NARROW-GAUGE SERVICE TRACKS.



SIDE HILL STEAM SHOVEL CUT AND DOWN HILL EMBANKMENT
CONCRETE PAVER SERVED BY WHITCOMB GASOLINE LOCOMOTIVE HAULING BATCH BOX CARS ON INDUSTRIAL TRACK.

At central storage the aggregate was loaded into five-bag batch boxes, each provided with a separate cement container so tight that it was possible to leave the cement in them over night in the rain without injury. The batch boxes were loaded in pairs on flat cars, four of which were hauled in trains by gasoline locomotives running on the single-track industrial line, which at the three principal grades was double-tracked to permit the cars to be hauled both up and down hill by the tractors that moved on the subgrade alongside the track and clear of it and were connected to the forward car of the train by a ⅞-inch plow-steel cable 37 feet long, with a spliced eye at each end. This length of rope was found by experiment to be correct to avoid derailment, both 25-foot lengths and 45-foot lengths causing trouble because they frequently pulled the front cars of the train off the rails.

(To be continued)

Heavy Increase in Construction

In February last construction activities in the 27 northeastern states was 73 per cent. greater than one year ago, according to the F. W. Dodge Co.'s review. February building contracts in New York and northern New Jersey in February amounted to more than $59,000,000. The next largest district construction comes from the Central West district and amounts to $45,000,000.

MARCH CONSTRUCTION WORK

During March $293,636,000,000 of building construction contracts were awarded in 27 northeastern states, showing an increase of 65 per cent. over Feb. ruary and being the largest volume of construction in any month since April 1920, according to the F. W. Dodge Co. Public utilities amounted to 18 per cent. The largest amount of construction in any one of the five districts considered was $88,506,000 in New York State and northern New Jersey. Contemplated new work reported in March was $613,-000,000.

Peekskill Bridge

A bill authorizing the construction of a bridge across the Hudson River near Peekskill, which was briefly referred to in PUBLIC WORKS March 11th, has been passed by the State Legislature and signed by Governor Miller and it is expected that the construction will be commenced promptly and prosecuted vigorously by the Terry & Tench Co., who have been interested in the promotion of the project.

The State has the right to take over the bridge after five years for $4,500,000, after 10 years for $4,000,000, after 15 years for $3,500,000 and after 20 years for $3,000,000 and after 25 years for $2,-000,000, the bridge automatically becoming the property of the state without cost at the end of 30 years, if not purchased before. Toll rates are limited to from $.10 for children to $3.00 for loaded moving vans.

SIDE CASTING BOULDERS, BLOWN DOWN SIDE HILL.

Heavy Loads on Highways

Actual weights of heavy loads on Massachusetts roads. Many eighteen to twenty-ton loads. Methods of weighing and of enforcing law limiting loads

During the summers of 1920 and 1921 A. P. Porter, inspector, Division of Highways, Massachusetts Department of Public Works, was employed, under Commissioner John N. Cole, investigating heavily loaded motor trucks using the Massachusetts highways. He described his work before the Boston Society of Civil Engineers a few weeks ago as follows:

"We started to weigh the trucks with two loadometers. The loadometer is a device on the screw-jack principle, with an oil gage attached to give the weight. The two instruments are first placed under the rear axle, screwed up until the wheels are off the ground and the readings taken. Then this process is repeated with the front axle. The sum of the four readings gives the total weight of truck and load.

"In using the loadometers, I found it is wise to choose a spot where the roadway is nearly level in both directions, for if one of the jacks stands on the sloping shoulder of the road, the side thrust will cause the screw to bind, and not only work very hard but may affect the readings.

"During 1920, 90 trucks were weighed by the loadometers, and in 1921 100 trucks by the loadometer and 400 on platform scales.

"The first two jacks which I used were calibrated to 20,000 lbs. each, but the second pair, supposed to be an improved model, have a capacity of only 15,000 lbs. each.

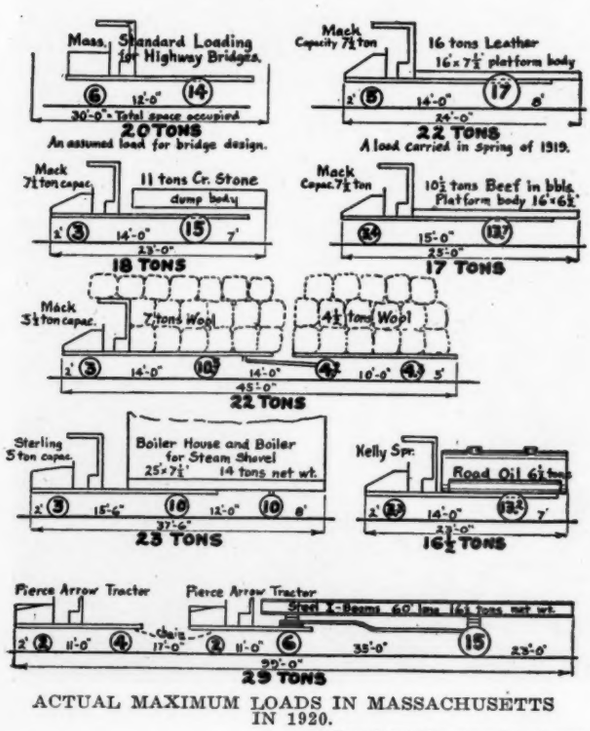
"The first truck I met after I began using these improved jacks was too heavy to be weighed with them and I had to resort to a neighboring 20-ton platform scale. The rear axle of this truck weighed 33,200 lbs., the heaviest axle load I ever weighed.

"The largest gross weight of a four-wheeled truck and load which we actually weighed was 38,300 lbs., and the largest load on six wheels was 40,000 lbs. The accompanying diagrams show the maximum loads we encountered. Undoubtedly there were some larger than these which did not happen to come our way.

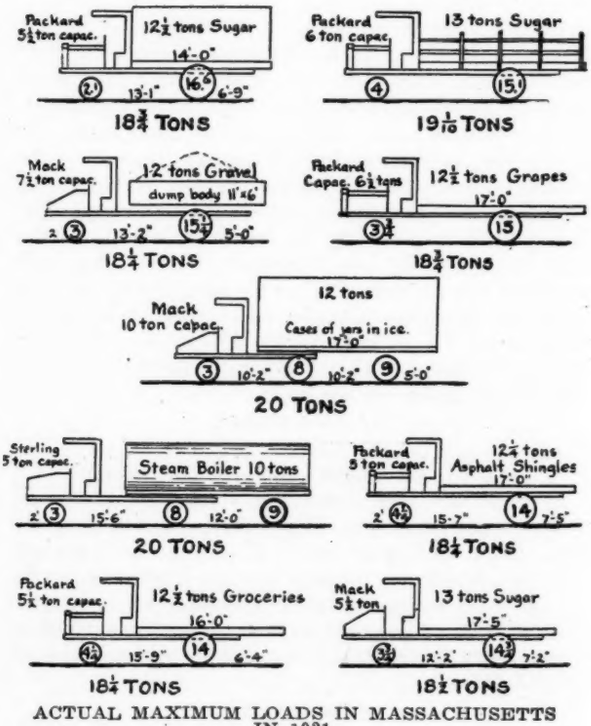
"The proportion of the weight which comes on the rear axle of a truck varies from 70 to 87 per cent. It is not constant for a certain truck. As more load is added, the percentage on the rear increases."

"It varies also with different makes of truck, different classes of commodities, length of wheel base, length of body, overhang, and how the load is placed. The Autocar has more of its load on the front. Loads of wool or cotton are sometimes piled forward over the cab. The average per cent. on the rear, for all makes, is about 78.

"The legal limit in Massachusetts for the weight



ACTUAL MAXIMUM LOADS IN MASSACHUSETTS IN 1920.



ACTUAL MAXIMUM LOADS IN MASSACHUSETTS IN 1921.

Load in thousands of pounds per wheel or ton per axle.

of truck and load is 14 tons, and outside the Metropolitan Parks and Sewerage districts there is also a limit of 800 lbs. per inch width of tire. Since the largest tire practicable is 14 ins. wide or its equivalent, two 7-in. tires, this practically limits the legal axle load to 22,400 lbs. even with the largest tires.

"When the weight of the truck and load was over the legal limit several hundred pounds or more, we summoned the driver to court. So far this year we had 116 cases in court and secured a verdict of guilty in 109 cases.

"Sometimes we made the truckman remove part of his load. On one occasion in Reading I stopped a truck going from Boston to Lowell which weighed 38,300 lbs., and another owned by the same company going to Lawrence which weighed 34,100 lbs. When told they could not proceed they telephoned to Boston for another truck, which came out and took 25 barrels of sugar off of one truck and 17 off of the other, which made this third truck overweight.

"When we started the investigation there were three facts we wanted to determine:

"1. *The Maximum Load.*—Actual weight of heaviest truck load and how its weight is distributed on the wheels. This is to be used as a basis for computing the greatest stresses in the pavement and in bridges.

"2. *Overloaded Trucks.*—The ratio of the actual load to the manufacturers' rated carrying capacity is called the "load factor." While we found some trucks carrying as much as two or three times the rated capacity, the average load factor for all the trucks carrying any load is about 1, and taking into account the trucks returning empty the average load factor is about 0.5.

"3. *Intensity of Traffic.*—A highway engineer is often called upon to compare the traffic over one road with that over another. For this purpose it is necessary to stop every heavy truck passing a certain point, ask the driver a number of questions regarding the weight of his truck and load, and find the total weight of all the trucks in a given period of time. I adopted 'tons-per-hour' as being probably the most convenient unit to express the volume of traffic. For instance, if one road carries ten times as many tons per hour as another, it is reasonable to suppose that the former road will wear out about ten times as fast as the latter and cost ten times as much to keep up, other things being equal.

"We divided the commodities carried into five groups:

"1. Crushed stone, gravel, etc.
"2. Oil, gasoline and tarvia in tank bodies.
"3. Groceries, meat and drinks.
"4. Wool, cotton and dry goods.
"5. Machinery, lumber and furniture.

"Our analysis of these figures shows some interesting conclusions; among others, that the loads going out from the city are very much greater than the loads going in toward the center. About 75 per cent. of the net load on any one of the through routes is going out from Boston, and only 25 per cent. coming in. If these could be more nearly balanced the efficiency of this kind of transportation would be very much increased."

Gasoline Trucks for Street Railway Cars

The distinction of being the first town in the United States where gasoline trucks are used exclusively for transportation purposes is claimed by Manhattan, Kansas. The Manhattan City and Interurban Railway Co. has decided to gasolinize its transportation system and four trucks are in daily service on the street railway tracks of the company. The cars used are of the four-wheel-drive type and are said to make a 5 per cent grade 2,500 feet long at 14 miles an hour. Each car has a seating capacity of 32 persons. They have electric starting and lighting devices, heating systems which utilize the heat from the motor exhaust, and weigh 7.240 pounds as compared with the 60,000 pounds weight of the electric cars.

Keeping Concrete Pavement Wet

Probably the method most commonly used for keeping a concrete pavement damp while curing is that of covering with earth which is wet down occasionally. In a number of instances, ponding is employed, but this is conveniently applicable only to roads that are practically level. The city of Seattle permits contractors to use either of these methods or, as a third alternative, continuous sprinkling.

Several years ago a contractor adopted the third method, using ordinary whirling lawn sprinklers, but these used excessive quantities of water and would be too expensive and unwieldy for a large contract. Recently another method of sprinkling has been used in Seattle which was devised by J. L. Smith, contractor for a 2½-mile improvement on a part of the Pacific highway in that city. W. H. Tiedeman, principal assistant city engineer, who describes this in the *Concrete Highway Magazine*, states that this is not only inexpensive and easily handled, but is, from the engineer's standpoint, a very efficient method of curing concrete.

"Mr. Smith had on hand from former county contracts, a large quantity of 1¼-inch pipe in about 20-foot lengths. These are coupled together with tees into which a ½-inch nipple, 3 inches long is screwed, and a stationary brass cap known as a "Mutt" sprinkler completes the installation. A simple adjustment of a screw regulates the amount of spray. The connected line is attached to a hydrant, which are about 300 feet apart in this city, and the concrete gang carries the connecting pipe onto the previous day's work, which takes only a few minutes. One man is employed to take care of the system during the day. On a recent job one-inch pipe was used and an even smaller diameter may prove sufficient for the supply line. Meters show that 41 cubic feet of water are used to wet 100 square yards per hour.

"The sprinklers are required to be in operation during the ordinary working hours, but in the summer months the night watchman is instructed to turn on the water about sun-up and to turn it off after sun-down. Our summer nights are always cool, so we do not expect serious evaporation to take place."

Mr. Tiedeman gives as additional advantages that the cost is small, costing the contractor less than an earth covering; it is simple to construct, it secures a

thorough and continuous wetting, and there is almost no expense for cleaning up afterward. It saves the destruction of parking strips by the storing on them of earth required for covering the pavement and also the tracking of dirt over the sidewalks, and leaves a perfectly clean pavement on completion.

Importance of Surface Finish of Pavements*

Life of a concrete road depends as much upon this as upon any other factor. Remedies for surface unevenness.

I believe that in a concrete road economically designed, the life of the pavement depends as much upon the surface finish as upon any other factor. We know now that impact is the great cause of destruction in our pavements. If the wheels of vehicles are smooth and the pavement surface is smooth there is no damaging impact from traffic. The road lives, even though it be weak in proportion to the volume and weight of traffic it must carry. But let surface irregularities develop, and no mater how strongly built, the whole pavement soon shows the effects of wear.

We build our roads on an average to withstand a pressure of 800 pounds per lineal inch width of tire. Yet, if an unevenness in surface of only ¼ inch occurs, the impact of one rear wheel of a five-ton truck may exert an impact pressure upon the road of 20,000 pounds. Under such pressure the unevenness becomes a depression whose edges spall and break, causing further impacts and more depressions until the pavement is badly damaged.

There are five general causes of unevenness in the pavement surface:

1. Foreign materials in the aggregate, which, failing to amalgamate, are ousted, leaving holes and depressions.
2. Non-uniform aggregates, which cause inequalities in wearing resistance to traffic, and subsequent depressions in the weaker places.
3. Poor workmanship in striking off and finishing.
4. Cracks, longitudinal and transverse, due to frost action, changes of temperature or unequal bearing power in the subsoil.
5. Uneven joints, perhaps the most common cause of surface trouble, due often to the piling up of joint material or to a difference in elevation of the slab surface.

The general remedies for surface unevennness are as obvious as the unevenness itself, and therefore, perhaps, as often neglected—strict enforcement of specifications exacting good material and good workmanship. Sometimes the letter of the specifications is violated, and frequently their spirit. When all engineers know their job so well that they can show contractors easier and better methods of doing their work, and when all contractors regard highway work as a legitimate industry and not a financial gamble, then we shall have that adherence to specifications that will insure good work and smooth surface.

Three general methods of preserving good surface finish once it is obtained, are the use of steel reinforcement; the division of the road longitudinally; and the wider spacing of joints with the use of dowels.

The advantages of steel reinforcement are that it gives the road greater bearing power and greater resistance to frost and that it offsets irregularities and weaknesses in the sub soil. By helping to preserve the integrity of the pavement it minimizes any tendency towards cracking, which is, of course, a cause of surface unevenness.

The division of the road longitudinally increases its beam strength about four-fold. Observation reveals that longitudinal cracks are not found in slabs 9 and 10 feet wide, though we have all encountered them in slabs beyond that width.

Transverse joints being a prolific source of trouble, it is well to diminish their number as far as possible through the use of the longer slab. This wider spacing of joints becomes feasible through the use of steel reinforcement to meet the temperature stresses of the slab. The use of dowels gives stability to the joints and holds the surface even. The submergence of joints an inch below the surface has proven unsatisfactory. Devised at first to secure a smooth surface and permit the use of a finishing machine, it seemed admirable until subsequent expansion crowded and crushed the concrete above the joint material, leaving a badly ravelled and spalled joint. The best method that I have found of making a joint is to submerge the joint material until after the screed or finishing machine has passed over it; then to lift the joint material slightly above the surface with long fingered tongs; then, to finish the joint with the split float or split roller, rounding the concrete next to the joint material with an edging tool.

The actual method of finishing is of course important in securing a smooth surface. Some road builders prefer to use the finishing machine with the roller and belt. It is essential that the roller be light. A too heavy roller pushes the crown out of the pavement, and spoils the surface. Most specifications call for a weight of from 12 to 15 pounds per foot length. Some builders omit the roller, using only the machine. My own experience indicates that the roller helps. One advantage of the finishing machine is that a dryer concrete can be used with it, which gives greater strength to the pavement. It also gives more uniform results than can be obtained with a green gang, and seems in general more foolproof than the hand method. Still, many prefer to strike off with the hand screed using the roller and belt. This has the advantage of making one piece of plant the less to get out of order and where a heavy screed is used in the hands of competent workmen it gives as smooth a finish as the finishing machine.

With either method the board belt gives unquestionably the best finish. The bow belt however, can give good results. Proper belting takes off not only the excess water, but also the clay loam, laitance etc., that tend to form a scale on the surface.

*Excerpts from paper by H. Eltinge Breed before the Good Roads Congress.

PUBLIC WORKS.

Published Weekly
at 243 W. 39th St., New York, N. Y.

S. W. HUME, President J. T. MORRIS, Treasurer

Subscription Rates
United States and Possessions, Mexico and Cuba $3.00 year
All other countries..... 4.00 year

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Subscribers are requested to notify us promptly of change of address, giving both old and new addresses.

Telephone (New York): Bryant 9591
Western office: Monadnock Block, Chicago

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CONTENTS

City Streets and Highways

Twenty-five years or even ten years ago the vehicles carried by highways outside of the limits or immediate vicinity of cities were much lighter than those carried by streets in the freighting and manufacturing sections of cities. Motor traffic was confined almost entirely to passenger vehicles. Considering this fact and the greater number of vehicles, pavements on city streets were made both wider and heavier than those on the rural highways.

But this is no longer the case. If anything, the highways now carry heavier loads than most city streets. An article in this issue tells of loads of fifteen to seventeen tons on a single axle found using Massachusetts highways, and five to ten tons is common in most states. There would, therefore, appear to be no longer any reason for planning highways for lighter loads than city streets.

There are, of course, differences in conditions other than weight of loads. City streets carry more vehicles than highways. Some popular highways are crowded with vehicles on Sundays, but a count would show that even then the total number is less than are found on the busiest streets of the nearest large cities on a week day.

City pavements are cut into for water, gas and other public service pipes and structures, which seldom occurs with highways, and the several trenches under streets both present weak places in the sub-grade and furnish drainage of it.

These differences between the two must be recognized in planning, constructing and maintaining street and highway paving. On the other hand, because of the increasing weights of loads on highways, it can no longer be taken for granted that a highway pavement need not be so heavy as a street pavement; or, consequently, that it will be cheaper to construct.

Importance of Sub-Grade

Another article in this issue tells in detail of changes made in plans and designs for city pavements, as described to us by more than one hundred and fifty city engineers, and it is significant that most of these changes are apparently for the purpose of securing a stronger pavement. They include thicker base, richer mix, use of reinforcement, etc.

For the reasons stated above, if there is a necessity for making city pavements stronger, the same necessity is even more urgent in the case of highways, where the increase in weight of vehicles has been greater.

There is this to be remembered, however, while the wear of the traffic is borne by the surface, the weight is ultimately carried by the sub-grade. And the heavier the load, the more important this principle becomes. It is absured to expect any pavement to carry an axle load of ten, fifteen, or twenty tons by bridging or in any way except transmitting it directly to the sub-grade. If this is not firm at all points, breaks are sure to occur.

The heavier the loads carried by a pavement, the greater the attention that must be given to the sub-grade.

Co-ordination of Construction Methods With Local Conditions

To conform to standard construction practice and avoid experiments is a wise rule, provided standards are understood to be general principles and types considered as independent units. The modification and combination of such units to best conform to varying requirements and unusual conditions is one of the most important elements of successful engineering construction.

The essential features of ordinary arangements and equipment are capable of a great variety of combinations and modifications that, without involving new or untried features, may produce great efficiency and economy where adherence to the usual routine even with substantially the same elements, would be very unsatisfactory.

The contractor who best knows the potential value of the various kinds of equipment on the market and what general methods and operations are successful and the conditions under which they are most advantageous, and possesses the ability to analyze his problem, anticipate his principal requirements and difficulties and fit available facilities to

them with skill and ingenuity, will be a large gainer in the rapidity, excellence and lower cost of his work. The net result is that the items of the equipment selected co-operate to the best advantage, and that the methods are arranged in accordance with the probable and actual developments of the work.

These principles are especially pertinent to long sections of highway construction where topography, transportation facilities, and the character of the construction itself may vary greatly at different points. In such cases location of headquarters, distribution of plant, sequence of operations and the best combinations and utilizations of available plant applied in ordinary or novel fashion, afford a wide field for successful operation.

Examples of excellent results obtained in this manner are offered by the Franklin Highway construction, described in this issue, where an elastic system of distribution was obtained by combining the advantages of the abundant available supply of tractors with those of an industrial railway service; the elimination of brakemen's wages and the increase of safety by special car devices applied on the steep grades; construction of a simple platform on a narrow side hill to utilize limited storage space and facilitate gravity handling of materials, and the carefully prearranged handling of cement bags so as to keep a maximum amount in storage without rehandling and to substitute automatic mechanical conveyors for hand work.

Recent Changes in Pavement Design

One hundred and fifty cities report changes made last year or this in base, binder, cushion, joint filler, kind or proportion of aggregate, use of reinforcement, and other details.

In response to inquiries addressed to several hundred city engineers asking what changes they had made recently in the details of pavement design, more than two hundred informed us that no changes had been made. However, about one hundred and fifty reported some changes, most of them in brick and concrete pavements and in bases for pavements. These changes, classified according to the kinds of pavements, were as follows:

SHEET ASPHALT

Little Rock, Ark., has increased thickness of binder course to 1½ inch minimum.

Los Angeles uses water-worn pebbles, crushed boulders or quarried rock, instead of quarried stone only, and has changed base mix from 1:3:6 to 1:2½:5 and surface mix from 1:1½:3 to 1:2:3½. For asphalt wearing surface both fine and coarse mix are now used instead of fine only, with the following changes:

	Prior to Aug., 1921	Subsequent to Aug., 1921	
	Fine mix Per cent.	Fine mix Per cent.	Coarse mix Per cent.
Asphalt cement	10 to 12	9.5 to 11.5	7 to 9.5
Sand and stone dust	13 to 17	13 to 18	9 to 13
Pass 80 mesh	20 to 25	18 to 28	7 to 12
Pass 50 mesh	17 to 22	16 to 24	10 to 16
Pass 30 mesh	18 to 24	18 to 26	18 to 24
Pass 20 mesh	4 to 8	4 to 9	10 to 16
Pass 10 mesh	2 to 5	2 to 5	11 to 18
One-half mesh	.....	.....	6 to 12

Fort Lauderdale, Fla., uses 10-inch macadam base instead of 8-inch.

Logansport, Ind., has abandoned combined curb and gutter, using curb alone, either monolithic with base or superimposed on it.

Fort Dodge, Ia., has reduced penetration required for wearing surface.

Topeka, Kan., has increased thickness of base from 5 inches to 6 inches.

Wichita, Kan., has reduced penetration of A. C. to 45 on traffic streets.

Madisonville, Ky., will use brick gutters on a 4-inch concrete base.

Lorain, O., will use concrete base 8 in. thick at center and 5 in. at sides of street.

Oil City, Pa., is changing from 1½ in. top and 1 in. binder to 1 in. top and 1½ in. binder.

Wilkes-Barre has changed the thickness of base under asphalt from 6 in. to 9 in. on the main thoroughfares.

Denton, Tex., will use 4 in. and 5 in. plain concrete base with 2 in. rock asphalt surface.

BRICK

Base

St. Petersburg, Fla., uses shell or rock foundation instead of sand in some cases.

Bloomington, Ill., has increased base for brick from 4 in. to 5 in. in residential streets.

Danville, Ill., is using a richer mix. and greater thickness for its base on heavy-traffic streets.

Mattoon, Ill., is changing from 5 in. to 6 in. thickness of base.

Waukegan Ill., has changed its mix. for concrete base from 1:3:6 to 1:3:5.

Chanute, Kans., has changed the thickness of concrete base from 5 in. to 6 in.

Emporia, Kans., has changed the thickness of concrete base from 4 in. to 5 in. and the mix from 1:3:6 to 1:3:5.

Ashland, Ky., has changed thickness of base from 6 in. to 8 in.

Sedalia Mo., intends to use heavier base than the 4 in. in residence districts and 6 and 8 in. in business that are now used.

Lexington, Neb., has increased thickness of concrete base from 4 in. to 5. in. and will increase it to 6 in. on heavy-traffic streets.

Johnson City, N. Y., is paying more attention to the water used in mixing the concrete.

Ashtabula, O., contemplates reinforcing concrete bases.

Jackson, O., is increasing the thickness of base 1 in.

Lorain, O., brick will have concrete base 7 in. thick at center and 5 in. at sides.

Painesville, O., has increased the base from 5 in. to 6 in. and 8 in. on heavily traveled streets.

Blackwell, Okla., is using a heavier base.

Greensburg, Pa., has substituted for base 8 in. of crushed furnace slag instead of 6 in. of granulated slag.

Greenville, Tex., has increased thickness of concrete base from 4 in. to 5 in., and uses graded aggregate in place of bank run.

Augusta, Wis., will lay brick on sand foundation.

Cushion

Bloomington, Ill., has reduced sand cushion from 2 in. to 1 in.

Chicago Heights, Ill., is using 1 in. sand cushion mixed with 20% of cement.

Mattoon, Ill., is changing from sand to bituminous mastic cushion.

Omaha, Neb., has changed from sand cushion to sand-cement cushion.

Huntington, Pa., in 1921 changed from cement-sand cushion to straight sand.

Brick

Bloomington Ill., will use some 3-in. brick.

Streator, Ill., proposes to use 3-inch vertical fibre brick on 4-inch concrete base.

North Tonawanda N. Y., has begun use of 3-inch vertical fibre brick on 4 in. to 5 in. concrete base.

Jackson, O., is using 3½ in. brick.

New Boston, O., is dispensing with nose brick along street railway tracks.

Sewickley, Pa., is now using 3-in. brick instead of 4 in.

Longview, Tex., has changed from 3 in. brick to 2½ in. on residence streets.

Filler

St. Petersburg, Fla., has changed from sand filler to asphalt filler.

Chicago Heights, Ill,. is using elastic filler instead of grout.

Mattoon, Ill., is changing from cement to bituminous mastic filler.

Murphysboro, Ill., will use asphalt filler for brick pavements.

Grand Rapids, Mich., has changed from cement grout to asphalt filler.

Binghamton, N. Y., has decided to use bituminous filler excusively.

Johnson City, N. Y., is paying more attention to the making of bituminous joints.

North Tonawanda, N. Y., is using asphalt filler with vertical fibre brick.

Bucyrus, O., is using soft filler instead of cement grout.

Greensburg Pa., has substituted asphalt filler for sand.

Rankin, Pa., has changed from cement grout filler to oil asphalt.

Wilkinsburg, Pa., is using oil asphalt filler instead of cement grout or sand.

Parkersburg, W. Va., has changed to asphalt filler except in street car tracks.

CONCRETE

Thickness

Napa, Cal., has increased thickness from 5 in. to 6 in.

San Bernardino, Cal., has increased thickness.

Norwich, Conn., has increased thickness to 7 in.—1:2:4 mix.

Ames, Ia., has increased the thickness to 8 in., using reinforcement.

Paducah, Ky., may increase thickness—now 6 in.

Gardiner, Mass., old design 6½ in., now uses not less than 7½ in. reinforced.

Pittsfield, Mass., has changed thickness from 9 in. and 7 in. to 8 in. and 7 in. and from plain to reinforced.

Hastings, Mich., has changed from 6 in. to 7 in.

Webster Grove, Mo., has changed from 6 to 6½ and 7 in. on residence streets, and from 8 in. to 8½ in. on through roads.

Camden, N. J., increased to from 7 to 10 in. according to traffic.

Little Falls, N. Y., will make all concrete 8 in. thick, with reinforcement.

Bellefontaine, O., may increase thickness in alleys from 6 in. to 7 or 8 in. and in streets from 8 and 6 in. to 9 and 7 in.

Lorain, O., will make concrete 10 in. thick at the center and 6 in. at sides.

Northampton, Pa., is increasing thickness from 7 in. to 8½ in. at the center.

Chehalis, Wash., has increased thickness from 6 in. to 7 in.

Olympia, Wash., has increased thickness on heavy-traffic streets.

Sheboygan, Wis., will increase thickness, which is now 8½ in. at the center and 6 in. at sides.

Wisconsin Rapids, Wis., has increased thickness from 6 and 8 in. to 7 and 8 in.

Mix

Palo Alto, Cal., now uses 6 sacks of cement, 0.51 cu. yd. of sand and 0.81 cu. yd. of rock per cu. yd. of concrete.

Derby, Conn., now uses 1:2:3½ mix.

Kendallville, Ind., two-course pavement, now uses 1:2½:4 for the base and 1:1:1½ for the wearing course.

Newcastle, Ind., two-course pavement, now uses 1:3:5 for the base and 1:1½:3 for wearing course; and for one-course, 1:2:3, 7 in. and 8 in. thick.

Greenfield, Mass., has changed from 1:2:3½ to 1:2:4 and added reinforcement.

Pittsfield, Mass., has decided on 1:2:3½ mix. with reinforcement.

Muskegon, Mich., has changed from 1:2:5 to 1:1½:3.

Greenville, S. C., will use a 1:2½:4 mix.

Wisconsin Rapids, Wis., has changed from 1:2:4 to 1:2:3½

Reinforcement

Edwardsville, Ill. is considering reinforcement.

N. Chicago, Ill., has used 40 lbs. of mesh reinforcement with a 1:2:4 mix. and one-course instead of two, 8 and 6 in. thick, with good results.

Oelwein, Ia., will use mesh reinforcement.
Wichita, Kans., will possibly use reinforcement.
Greenfield, Mass., has adopted reinforcement.
Holyoke, Mass., has adopted reinforcement.
Pittsfield, Mass., has adopted reinforcement.
Worcester, Mass., used reinforcement for the first time in 1921, with a 1:2:4 mix.
Detroit, Minn., has changed weight of reinforcement from 30 lbs. to 40 lbs. per 100 sq. ft.
Webster Grove, Mo., will use 44 lbs. and upward.
Freemont, Neb., will probably use road mesh.
Irvington, N. J., has changed from mesh to bars.
Newton, N. J., has changed from mesh to bars.
Nutley, N. J., will use reinforcement.
Herkimer, N. Y., is trying double fabric reinforcement.
West Park, O., will increase weight from 25 lbs. to 40 lbs. per 100 sq. ft.
Shawnee, Okla., is to use reinforcement.
Altoona, Pa., has increased weight of mesh from 25 lbs. to 56 lbs. per 100 sq. ft.
Monongahela, Pa., will use 40 lb. triangular wire mesh.
Wichita Falls, Tex., is increasing weight to 50 lbs.
Logan, Utah, uses marginal reinforcement instead of 28 lb. wire mesh.
Manitowoc, Wis., is using heavier reinforcement.
Sheboygan, Wis., will increase weight to about 40 lbs.

MISCELLANEOUS.

Centralia, Ill., has adopted concealed joints.
Marion, Ill., will not construct expansion joints but will use a thin metal plate for contraction joint.
Charles City, Ia., will use trap rock instead of gravel as aggregate.
Iowa City, Ia., will use no expansion joints, but fill lateral cracks with filler.
Oelwein, Ia., will use expansion joints.
Baltimore, Md., will permit either gravel or crushed stone in a 1:2:4 mix.
Fairibault, Minn., has increased the amount of crown.
Irvington, N. J., is using corrugated metal strip, 24 gauge, painted, in the center of the road, which is built in two longitudinal sections.
Lackawanna, N. Y., is using crushed slag in place of crushed stone.
Eugene, Ore., expects to use some integral curb.
Lebanon, Pa., has decreased thickness expansion joints to ⅜ in.
Philadelphia, Pa., will lay all concrete pavement, where the soil is clay, on a crushed stone or slag subbase 4 in. thick.
Rutland, Vt., uses larger type of stone dowels at all joints.
West Allis, Wis., has changed from two-course to one-course.
Wisconsin Rapids, Wis., is using separate curb and gutter.

BITUMINOUS CONCRETE

Prescott, Ariz., has changed from 4 in. base to 5 in. base, with no expansion joints.
Burlingame, Ark., has increased the size of rock in Topeka mix.
San Francisco, Cal., is gradually eliminating straight asphalt type and using 1½ in. top on 6 in. cement concrete base.
Pocatello, Ida., is using bitulithic top on 6 in. reinf. concrete base instead of crushed rock base.
Ashland, Ky., is changing from macadam to concrete base.
Clarksdale, Miss., expects to use 6 in. concrete base.
Rutherford, N. J., contempates using asphaltic base.
West New York, N. J., is increasing thickness of base by 1 to 2 inches.
Geneva, N. Y., is increasing thickness of concrete base from 5 in. to 6 in.

OTHER KINDS

Baltimore, Md., has changed mix of cement-sand bed for block paving from 1:4 to 1:3.
Omaha, Neb., has cut out sand cushion for creosoted wood block.
Newark, N. J., uses asphalt and sand filler for granite block instead of cement grout or cement and sand.
Port Chester, N. Y., has increased thickness of base for asphalt block.

MISCELLANEOUS

Tucson, Ariz., is making more extensive use of bituminous base instead of cement concrete where subsoil is caliche.
Anaheim, Ark., is using thicker base and richer mix.
Santa Maria, Cal., has changed from oil macadam to concrete account of freight rates.
Chicago, Ill., has increased base from 6 in. to 8 in., 1:3:6 mix., for heavy traffic streets.
Elwood, Ind., uses heavier designs and better drainage. "Why not a layer of crushed stone under all bases when subsoil is heavy clay or loam?"
Fort Wayne, Ind., has changed concrete base from 1:3:6 mix. to 1:2:4.
Marion, Ind., secures better drainage and thicker foundation.
Creston, Ia., has increased minimum base thickness to not less than 5 in.
Hutchinson, Kans., is using thicker base.
Three Rivers, Mich., now builds combined curb and gutter instead of curb only.
Rochester, Minn., has changed thickness of base from 4 in. to 5 in. and mix. from 1:3:8 to 1:3:6.
Lincoln, Neb., has adopted the use of expansion joints in concrete base.
Buffalo, N. Y., now places reinforcement over all cuts.
Cincinnati, O., now uses 8 in. concrete base on heavy-traffic streets instead of 6 in.
Conneaut, O., is using heavier base.
E. Cleveland, O., has increased the percentage of the large aggregate in the base.
Toledo, O., is increasing the thickness of foundation on heavy-traffic streets.
Oklahoma City, Okla., is using a thicker base, with 5 in. a minimum.
Monongahela, Pa., is using a thicker base.
Pittsburgh, Pa., has increased thickness of base from 6 in. to 8 and 9 in.
Bristol, R. I., is using a heavier base.
Green Bay, Wis., will make combined curb and gutter of one-course construction, using 1:2:3 mix.
Janesville, Wis., is changing concrete base from 5 in. to 6 in. on most work.

Maintenance of Roads

Information on the subject, tabulated from reports furnished especially for this issue by highway officials of more than five hundred counties. Mileage maintained, cost of maintenance, where patrol maintenance is used and where gang, equipment of each, work done, etc.

Patrol Maintenance

County and State	Roads on which patrol maintenance is used	Average length of patrol section, miles	Equipment of Patrolman
Alabama			
Montgomery	gravel	20	4 mule, 2 wagons, rd. mach., etc.
Arkansas			
Hempstead	gravel	12	Grdr, 2 trucks, plow, slip shovels
Colorado			
Elbert	Gravel surf	....	.....
Lake	Between ranches	2	Team & drag
Lincoln	State	40	Truck & drag & light grader
Logan	2,500 mi. co. rds.	....	6 teams, 8 trucks, engine
Delaware			
New Castle	All impr rds.	5	.....
Idaho			
Benewah	State	8.52	2-ton truck, patrol grader
Power	....	5	Drag, fresno, plow, wagon
Illinois			
Bond	Earth	3-6	Drag
Christian	27 mi.	4	Drag, grader & small tools
Clay	Earth	....	Tractors, truck, teams, graders, drags, levelers
De Witt	Co.; starts Apr. 1	25	2 men, tractor & maintainer
Fulton	State aid	8	Grader, drag, small tools
Johnson	Earth	....	.....
Lee	All state aid rds.; gravel, stone & earth	8	Grader, scraper, wagon, small tools
McDonough	Dirt	....	Drag & spade with 2 teams
McHenry	20% of total mileage, main rds.	8.6	Grader & scraper, team & wagon, shovels, etc.
Monroe	State aid rds.	3	Drag & scraper
Pulaski	Gravel rds.	10	Light grader, drag, shovel
Stephenson	200 mi. co. rds.	8	Team, wagon, patrol grader, plow scraper, drag, shovel, spade, axe, bar, hammer
Williamson	State aid	....	.....
Winnebago	Earth	4	Grader, 2 horses, rd. drag, small tools
Woodford	Dirt or oiled earth	30	Truck, drags, maint. machines
Indiana			
Decatur	Macadam	25	Grader, drags, plow, scrapers
Henry	Gravel surf	8	Team, drags, graders.
Jackson	.....	10	Grader, drags, picks & shovels
Posey	.....	25	Drags, scraper, graders, plows, harrows
Shelby	Gravel	12	Drag & grader
St. Joseph	Gravel	16	Grader, drag, small tools
Vigo	All	20	Grader, drag, scraper & plows
Wayne	Gravel	25	Graders, 4 & 2 horse drags

County and State	Roads on which patrol maintenance is used	Average length of patrol section, miles	Equipment of Patrolman
Iowa			
Adair	Earth	10	Plow, slip scraper, buck scraper, grader, small tools
Allamakee	State rds., earth	7½	Grader, drag, plow, scraper, axe, picks, shovel
Benton	Primary & co.	30	Truck, tractor, maintainer, cletrac, wheeler, small grader
Black Hawk	All	10	Small grader, team, wagon, scrap.
Boone	All	10-21	Blade, shovel, picks, spades, scraper, plow, wagon, small tools
Bremer	All prim. & co. rd.	7-10	Grad., plow, shovel, axe, pick & slip
Buena Vista	Primary gravel	6	2 horse grader & misc. tools
Cass	Dirt	6	Drag, slip, plow & hand tools
Cerro Gordo	Earth & gravel	7	Blade, wag., slip, drags, small tls.
Chickasaw	all	6	Truck, team, maint., small tools
Clarke	Earth rds	6	Grader, slip, drag, hand tools
Clay	Gravel	7	Wagon, pat. grader, small tools
Clinton	All	15	Trucks or team, drags, blade, sml. tools
Crawford	Earth	8	Team, wagon, grader, etc.
Dallas	....	20	Maint., tractor, grader, 2 men, small tools
Davis	....	9	Patrol grader, slip, plow
Decatur	Earth	12½	Grader, slips, plow, small tools
Dickinson	All rds.	10	Team, wagon, grader, shovel
Dubuque	Co. & prim. rds.	7	Maint., engine, grader, slip
Floyd	Earth & gravel	team, 5-6; motor, 12-24	Plow, pick, shovel, crowbar, scythe, scraper, wagon, grader
Guthrie	Earth	8	Drag, plow, small tools
Hamilton	Gravel	20	Tractor or truck & maint.
Hancock	Main rds.	15	Grader, slip, wheeler, plow, small tools
Harrison	Dirt	5	Drag, blade, small tools
Jackson	Prim. co.	5-6	Team, patrol, grader, slip, drag, hand tools
Jasper	Earth & gravel	12	Truck, plow, slip, grader, drag, small tools
Kossuth	Dirt & gravel	22½	Drag, engine, maint.
Linn	Earth	10	Plow, slip, drag, grader, small tls.
Lyon	All	5-10	Grader, slip & wheeler
Marshall	Gravel, dirt	18	Drag, grader, small tools
Mitchell	All	5	Scraper, plow, team, wagon, blade grader, small tools
Monona	Earth	8	Tools, blade, slips, plows
Monroe	Earth	8-10	Team, slip, plow, small tools
Montgomery	Dirt	7	Patrol grader, slip & small tools
Muscatine	Conc., grav., earth	20	Tractor, grader, maint., drags, plow, slips

Patrol Maintenance—(Continued)

County and State	Roads on which patrol maintenance is used	Average length patrol section, miles	Equipment of Patrolman
Iowa (Continued):			
Palo Alto	....	12	Slip, scraper, drag, grader, small tools
Pocahontas	Earth & gravel	11	Drag, grader, wagon, small tools
Pottawattamie	Co. & prim.	7	Maint., slip, shovel, axe
Ringgold	Earth	6	Grader, plow, slip, shovel, mower, axe
Sac	150 mi. gravel & graded earth	10	Wagon, drag, grader, small tools
Scott	All	5 pav. 10 earth	Truck or team, shovels, slip
Shelby	Earth	4	Drag, grader, brick, slip, plow
Story	Earth & gravel	12-20	Grader, truck & tractor
Union	Earth	8	4 horse & light maintainer
Wapello	All dirt	8	Drags, light graders
Warren	State & co. system	18	Team, wagon, grader, slip, plow, small tools
Wayne	Dirt	20	Grader, scraper, drag, plow, etc.
Webster	Earth & gravel	15	Truck&maint. or tractor&maint.
Worth	Gravel & earth	10	Grader, plow, slip, etc.
Kansas			
Anderson	Gravel	10	Grader, drag, shovel, pick, hammer, 2 slips, plow
Barton	....	5	Slip, shovel, drag, grader
Bourbon	All paved rds.	....	Truck, grader, scarifier, water tank, pumps, broom
Butler	Dirt	14	Team, wagon, grader, slip, plow, small tools
Clay	Dirt	3	Plow, scraper, drag
Cloud	Dirt	4	Drag
Doniphan	Earth	2½	Drag, plow, scraper
Geary	Dirt	6	Grader, 3 scrapers, plow
Greeley	Earth	6	Drag & shovel
Harvey	....	3-6	Rd. drag & maint.
Jackson	Dirt	12.5	Tractor & team
Kearny	Earth	5	Drag, plow, scraper
Mitchell	Earth	3	Drag, slip, snow drag
Montgomery	Earth	8	Grader, drag, slip, small tools.
Neosho	Gravel	20	Drag, grader, hand tools
Pawnee	Dirt	4.5	Drag, grader
Republic	Dirt	6	Drag, slip, shovel
Sheridan	Dirt	5	Drag, slip, shovel
Sumner	Earth	3	Drag
Wabaunsee	County	4-5	Drag, scraper
Wichita	Earth	6	Drag, shovel
Kentucky			
Boyle	W. B. mac.	10	Wagon & team, brooms, shovel, truck & grader
Henderson	All	15	Grader, drag, shovel, axes
Owen	V. B. mac., surf treated	8	Light tools, small truck
Shelby	bitum. surf	10	Horse, wagon & hand tools
Trigg	Gravel	9	Team, drag, grader, small tools
Maryland			
Kent	conc. & mac.	3	Grader, drag, tar pot & gravel tools
Michigan			
Alger	Mac. & earth	8	Graders, trucks & drags
Branch	.. ..	15	Truck, grader, drags, plows
Eaton	Gravel	10	grader, drag, shovel, rake, axe
Huron	....	8	Garder, rake, shovel, wagon
Kalkaska	Gravel	6	Wagon, shovels, picks, floats
Luce	Dirt	6	Wagon, grader, drag, small tools
Macomb	Gravel	7-13	Grader, shovel, etc.
Michigan (Continued):			
Mecosta	Gravel	12	Team, wagon, grader, small tools
Oakland	Gravel	5	Rd. float & grader
Ontonagon	All	6	Drag, etc.
Minnesota			
Aitkin	....	7	Blade, grader & planer
Blue Earth	Gravel & earth	7-10	Planer, grader, scraper & small tools
Chippewa	Gravel & dirt	5	Grader, mower, slip, wagon
Clay	Earth & gravel	8	Grader, scraper, wagon, mower
Cottonwood	Gravel	7	Grader, drag, wagon, scraper
Crow Wing	....	45	Drag, shovel, rake, etc.
Dakota	Gravel	5	Blade, machine, wagon, shovel, picks, teams
Dodge	Gravel	6-7	Drag , grader, wagon, shovel, rake, mower, etc.
Faribault	Gravel	6	Grader, team, wagon, mower, small tools
Goodhue	Gravel	5-7	Grader, dump wagon, planer, mower
Grant	All	6	Grader, wagon, slip, drag, plow
Hubbard	Earth & gravel	8	Planer, grader, scraper
Isanti	Gravel	8	Grader, drag, hand tools
Jackson	Gravel	7	Grader, scraper, mower, shovel
Kandiyohi	Gravel	5	Blade grader
Lake	State rds.	6	Team, grader, shovel, pick, rake
Lincoln	Gravel	7-8	Team, blade, wagon, plow, slip
Lyon	Gravel	8	Grader, wag., mower, scrap., team
Martin	Dirt & gravel	4	Drag or blade
Meeker	Gravel	6	Grader & small tools
Murray	....	6	Blade grader
Nobles	Earth & gravel	8	Hiway patrol, drag & hand tools
Norman	All	8	Grader, wagon, mower, dump boards, etc.
Ottertail	....	6	Grader, scraper, wagon, drag, mower, hand tools
Pope	Gravel	6	Grader, drag, small tools
Redwood	Gravel	6-8	Grader, wagon, scraper, shovel, pick
Rice	All	5	Grader
Roseau	All	8	Grader, drag, team & wagon
Stearns	State aid	9	Grader, drag, small tools, team
Swift	All	7	Grader, mower, slip, shovel, wag.
Todd	Earth & gravel	6	Drag, grader, small tools
Washington	All state aid rds.	6	Grader, wagon & team, plow, scraper
Watonwan	Gravel	6	Blade, wagon, mower, small tools
Missouri			
Cooper	Earth	Dists.	Earth rd. bldg. machinery
Jasper	....	4	Team, wagon & rd. drag
Washington	20 mi. gravel	2 men to 20 mi.	Truck, small tools
Montana			
Custer	Gravel & dirt	100	Truck, drag
Musselshell	Dirt	8	Team, wagon, drag, pick, shovel
Prairie	All graded rds.	7	Drag, wagon, scraper, pick & shovel
Richland	Dirt	6	Drag & shovel
Sheridan	....	8	Drag, fresno, plow, pick, shovel.
Toole	State hwys.	10	Rd. drags.
Valley	Graded dirt	7	Grader & maint.
Nebraska			
Knox	Earth & gravel	12	3 trucks, 2 teams
Morrill	State rds.	15	Trucks, drags, maint.

Patrol Maintenance—(Continued)

County and State	Roads on which patrol maintenance is used	Average length patrol section, miles	Equipment of Patrolman
New Jersey			
Salem	All	4-6	Scraper
Sussex	W. B. mac.	5	Truck, mixing box, small tools
Union	Macadam	2	Wheelbarrow, hand tools
New York			
Chautauqua	macadam	10	Truck
Niagara	....	5	Horse, wagon, shovel, pick, pouring pot, broom, etc.
Oswego	State	14	Truck, small tools
Schuyler	State & co.	12	Truck
Tompkins	State	5	Truck
Yates	State	12	Truck
North Carolina			
Forsyth	Soil	4	Rd. machine & drag
Graham	State	13	Truck, tractor, scraper, drag
Washington	sd. clay & top soil	50	Tractor, mules, graders, drags
Yancey	....	10	.....
North Dakota			
Barnes	Dirt	....	Truck & drag
Cass	Earth & gravel	60	Tractor, blade & drags
Grand Forks	All	8	Drag, mower, grader
Hettinger	Dirt	20-40	Truck, drags, fresnos
Ward	State gravel rds.	20	Truck, drags
Williams	Earth-conc.	6	Drag, small equip.
Ohio			
Fairfield	220 mi. co. rds.	3-20	Drag, grader, small tools
Hancock	State	....	Truck, tar kettle, grader
Logan	Gravel & stone	4-6	Drag & grader
Ottawa	Macadam	....	Patching only done
Pickaway	Gravel	6	3 teams, 4 men
Pike	Gravel	4	Drag, wagon, team
Oklahoma			
Carter	Gravel & dirt	6	Drag, pick, shovel, slip, wagon, 2 teams
Ellis	Dirt	5	Drag, scraper, 4 horses
Garfield	Dirt	30	Tractor, truck, drag, grader, shovels, etc.
Grady	Co. & state	....	Grader, tractor, fresnoes, conc. mixers
Major	Bridge repair	20	Truck, drag, fresno, wheels, trac.
Oregon			
Grant	Gravel	15	Truck, drag, scrapers, teams, plow, scarifiers, etc.
Marion	Main rds.	6-9	Hoe, rake, shovel, wheelbarrow
Pennsylvania			
Jefferson	Dirt	4	Drags, shovels, picks, rakes
South Carolina			
Aiken	....	12	.....
Chesterfield	Gravel & top soil	12	Drag, rd. plow, tractor, truck
Greenwood	All impvd. rds.	16	Truck, kettle, drags, small tools
South Dakota			
Codington	Gravel	10	Blade, wagon, small tools
Custer	Dirt & gravel	7½	Team, drag, grader, small tools
Day	Gravel	9	Team, wagon, blade, mower, slip, small tools
Faulk	Contract	10	Engine, 2 drags
Gregory	Earth	5	8 ft. drag
Haakon	....	6	Plow, slip, grader, drag
Hanson	Gravel	9	Grader & wagon
Jackson	....	10	Drag, maint., fresno
McCook	Gravel	....	.....
Meade	Dirt	10	Drag & shovel
Miner	....	35	Small engine & drag
Spink	Earth	12-20	4 horses, drag, scraper, plow
Sully	Earth	....	Engine, maint., small tools
Yankton	Earth	10	Drag, fresno, dump wagons, small tools

County and State	Roads on which patrol maintenance is used	Average length patrol section, miles	Equipment of Patrolman
Tennessee			
Bradley	Rock crushed	....	.....
Hamilton	All	10	Horse & wagon, pick, shovel, asph. kettle
Hawkins	Dirt	3	Pick & shovel, dynamite
Montgomery	Gravel	....	Truck
Rutherford	....	16	Shovel, pick & tamper
Texas			
Aransas	All	3 to co.	Two Trucks, graders, etc.
Colorado	Dirt	10	Team, drag
Madison	Earth	10	Tractor, planer & grader
Wichita	Concrete	36	2 trucks, blade, wagon, small tools
Virginia			
Halifax	Soil	6	Team
Scott	Macadam	6	Wheelbarrow, kettle, pick, shovel
Washington			
Asotin	Prim. state hwys.	10	Truck, rd. fixer, small tools
Clallam	Gravel	20	.....
Douglas	Gravel	13	Truck & grader
Grant	All surf. rds.	9	Truck or tram, rd. fixer or drag, fresno, rake, pick, shovel
Jefferson	All	25	Truck, graders
Lewis	Grav., hard surf.	15 grav., 20. h.s.	Grader, drag, truck, tractor
Lincoln	Gravel surf. rds.	11	Fixer, drag, grader, tools
Okanogan	Gravel	7	Grader, truck, rd. fixer
Pierce	Conc., asph., asph. conc., brick	....	.....
Whitman	surf. rds.	10	Team & blades
West Virginia			
Braxton	....	....	Graders, drags, teams
Brooke	Impvd. rds.	3½	Shovel, pick, mattock, wheelbarrows, etc.
Hancock	State	8	Truck, rd. machine, small tools
McDowell	Dirt	....	Rd. machine, scrapers, drags
Monongalia	All	....	Tractor, truck, graders, drags
Polk	Dirt & gravel	8	Grader, fresno, drag, small tools
Upshur	All	conc. 5	Pick
Wisconsin			
Adams	Sand-clay	9	Planer, drag, plow, scrapers, wagon, small tools
Brown	Gravel	8	Truck, teams, motor graders
Buffalo	State & co. rds.	6½	Team, wagon, grader, drag, scraper, plow
Fond du Lac	Co. & state	8½	Team, scraper, plow, slip, drags
Forest	Co. & state	6½	Grader, drag, shovel, pick, rake
Grant	All	8	Grader, drag, plow, scraper, etc.
Jefferson	Clay gravel	8	Team, wagon, drag, grader, pick, shovel, scraper, plow
Juneau	Clay	10	Grader, planer, drag
La Crosse	Macadam	10½	Truck, drag, grader, small tools, tar kettle
Lincoln	Earth & gravel	7⅜	Grader, planer, wagon, tools
Monroe	Sand & clay	5.75-7⅔	Horse patrol
Price	State & co.	6½	Teams, grader, wagon
Sawyer	Earth	8	Team, grader, drag, plow, wagon
Vernon	Earth	6.5	Grader, drag, scraper, hand tools
Walworth	Co. & state	8	Grader, wagon, scraper, plow,
		8	pick, shovel, etc.
Waukesha	State & co.	8	Grader, dump wagon, small tools
Winnebago	All	8	Grader, wagon, small tools
Wyoming			
Lincoln	State rds.	8 12	Teams, drag, plow, small scraper
Weston	Earth, dragging	20	Truck, drag, small tools

Gang Maintenance

County and State	On What Roads Gang Maintenance is used	Kind of Work Done	Standard Equipment.	Number of men in a gang.
Alabama				
Etowah	Convicts on main rds.	Haul dirt or gravel in holes, clean ditches.	Graders, wagons, tractor, scarifier, picks, shovels, etc.	10-20
Montgomery	gravel	Surf. and ditch work, etc.	.....	3-5
Arkansas				
Hempstead	earth	Clean ditches, shape crown.	Grader, plow, slips, shovels, wagons.	6-12
California				
Fresno	all	Shape earth shoulders and drag gravel rds.	1 man, power graders, truck,	1
Sacramento	conc. & asph. mac.	Fill cracks in conc., patch conc. and asph. mac.	Truck, asph. kettle, pick, shovel, rake, small tools.	3
Sutter	conc. & oil mac.	Gravel shoulders, oil cracks, patch guard rails.	Truck, oil patching, outfit.	3
Colorado				
Chaffee	.....	Grad., drag, fix old culverts, etc.	Horse & wagon, or truck.	2-5
Elbert	.....	Haul gravel, make repairs.	2 men w. truck, hand tools.	2
Lake	all	All repairs.	Truck, pick, shovel.	3-20
Lincoln	state 40 mi.	.....	Truck, drag, light grader.	2
Logan	75 mi. state rd.	Drag, fill up holes, etc.	Teams, truck, engine.	10
Delaware				
New Castle	.....	Repair rds.	.....	..
Idaho				
Clark	only in summer	Regrad. small jobs, gen. rep'rs.	....	5-10
Shoshone	gravel	Resurf., light grad., drain pipes, etc.	Grader, plow, 2 Fresnos, 2 slips, truck.	4-10
Illinois				
Bond	earth	Grad. and bridge work.	Tractor, grader, maint., con. mixer, scrapers, plow.	3-6
Fulton	earth	.....	Tractor or grader.	4
Knox	dirt	Grade and drag.	Truck, rd. maint.	2
Lee	.....	.....	Grader, Holt Caterpillars.	..
Logan	all	Earth and gravel work.	.....	..
McDonough	dirt	Clean ditches, build shoulders, grade.	Tractor, grader, leveler, teams, small tools.	4
McHenry	.....	Heavy grading.	Engine, heavy grader.	3
Monroe	state aid	Clean and grade earth rds.	Grader, tractor, 4 scrapers.	6
Pratt	earth	Grade and run tractor.	Tractor, grader, leveler.	2
Scott	state aid	Grade and machine maint.	Tractor, grader, back sloper, leveler.	2
Stephenson	all co. rds.	Patrol and haul. gravel, open ditches, clean culvts., cut brush	Tractor, blade grader.	2
Woodford	.....	Clean culvts., mow weeds, apply rd. oil.	Truck oiler, drags.	4
Indiana				
Dubois	105 mi. mac.	Open side ditches, fill holes, rough repair.	Truck w. shovels, grader, etc.	..
Hancock	.....	Grade and drag.	Graders, drags.	2-6
Henry	.....	Grade repair. & reconst. side drains.	Trucks, plows, graders, tractor, engine.	..
Madison	all	Everything.	Graders, drags, shovels, brushes, etc.	..
Posey	all	Repair.	.....	..
Shelby	.....	Haul. material.	Wagon and team.	..
St. Joseph	grav., conc., asph.	All but grade & spread mate.	Trucks, tractor, grader, gravel screen., plant, drag, small tools.	2-25
Vigo	heavy repairs	Grade, resurf., conc. repair	.....	..
Wayne	.....	Hauling gravel.	Trucks, loader, cable dip. outfit.	8
Iowa:				
Adair	earth	Fills at bridges & culvts., grades in low places.	Scrapers, graders, rd. planers, 8 teams.	10
Allamahee	earth	.....	Tractor, grader, plow, scrapers.	4-12
Benton	co. & primary	Raise low places, blade grade.	Tractor, 2 graders, Ford tractor, wheeler.	2-4
Black Hawk	earth & gravel	Ditch. and smooth.	Grader & tractor.	..
Boone	.....	Grade and gravel.	Tractors, blade.	3
Bremer	.....	Blade grading	.....	3
Buena Vista	all	Heavy blade grad., maint. grav.	Tractor & blade.	..
Cass	dirt	.....	Grader, tractor.	2
Cerro Gordo	concrete	Tar cracks, repair shoulders.	Tar heater, truck, wagon, small tools.	4
Chickasaw	.....	.....	Tractor, blader.	2-6
Clark	blade grader wk.	Dig ditches, dirt on crown of rd.	Tractor, grader, slips, plow, team.	3
Clay	gravel	Resurf., reshape dirt rds.	10-ton Holt, 12-ft. blade for reshaping.	3
Clinton	earth	Emergency.	Teams and wheelers or slips.	..
Crawford	earth	All sorts.	Motor truck.	5-6
Dallas	mostly earth	Make sm. fills on rds & culvts.	Plow, wheelers, slips, sm. tools.	2-6
Davis	dirt	Heavy blade grad.	Tractor, grader.	2
Decatur	earth	Widen, grade, make large fills.	Grader, Fresnos, wheelers, slips.	7-12
Dickinson	all	Tiling and major repairs.	.....	..
Dubuque	earth, gravel	Ditch work, resurf., etc.	Wheelers, slips, trucks, sm. tools.	5-10
Floyd	earth, grav., pavt.	Fill cracks, repair should., clean right way.	Tar kettle, buckets, wheelers, slips, truck.	3-6
Guthrie	earth	Build up grades, clean ditches.	Elev. grader, wagons, plows, scrapers.	12
Hamilton	all	Smooth.	Tractor & graders.	3
Hancock	dirt	Grade.	10-ton Tractor, blade grader.	3
Harrison	heavy maint.	.....	Engine, grader.	2-6
Jackson	all	.....	Tractor, grader, rd. planer, team.	4
Jasper	earth	.....	Tractor, grader, slip, plow, team.	3
Linn	earth	Repair .	Wheeler scrapers, plows, scrapers.	8
Lyon	all	Trim & ditch all co. rds.	Holt, blade grad., drag.	2
Marshall	dirt	Tractor grad. & team work.	.....	..
Mitchell	earth, gravel	Fills, tiling, blade grader wk.	Tractor, blades.	..
Monona	earth	Temporary grading.	Tractor, maintainer, blade.	2-3
Montgomery	dirt; heavy rep.	Gen. repairs & earth rd.	Maint., blade graders.	6
Muscatine	earth	Regrade rds.	Tractor, grader, team, slip, wag.	3
Pocahontas	gravel	Shape grade for surf. or resurf.	Blade, grader, trucks.	2-7
Pottawattamie	co. & prim. rds.	Engine grader wk., fill bridges and culvts.	Engine graders, wheel scrapers.	3-20
Ringgold	.....	Blade grading.	Tractor, Grader.	2

Gang Maintance—continued

County and State	On What Roads Gang Maintenance is used	Kind of Work Done	Standard Equipment	Number of men in a gang
Iowa (Continued):				
Sac	grav. & grad. earth in sum.	Reshoulder, reditch, recrown, haul gravel.	Tractor, blade grader, trucks.	2-5
Scott	earth & grav.	Resurf., blade grader wk., rip rap, oiling.	2 Trucks, tractor, grader, roller, oilers, slips, wheelers, shovels.	6-10
Shelby	earth	All heavy grader work.	.....	..
Story	earth & grav.	Grade and gravel surf.	Tractor, grader.	2
Union	earth	Heavy grader and wheelers.	Varies.	3-10
Wapello	dirt	Grade.	2 Tractors, grader, maintenance.	4
Warren	state & co.	Blade grader.	Tractor, grader, wagons, small tools.	2
Wayne	dirt	Ditch line work.	Wheel, scrapers, drag scrapers	6
Webster	.....	Resurf. and reshape.	Mostly by contract.	..
Worth	gravel & earth	Heavy repair work.	Wheelers, plow, slips, etc.	7-8
Kansas:				
Anderson	dirt	Drainage open, repair grade.	3 wheelers, 4 slips, plow.	10-15
Barton	concrete	Shoulder work & fill. cracks.	.....	2-4
Bourbon	all paved rds.	Surf., shoulder, mow. weed, patch.	Truck, tools, grad., scarifier, water tank, etc.	2
Clay	dirt	Blade grader wk., fills, etc.	Tractor, grader, maint.	..
Doniphan	earth	Cuts & fills, reduce grades.	Plow, drag, 3 or 4 scrapers.	4-5
Geary	hard surf. rds.	Shoulder, clean. ditches, rep. cul.	Shovels, conc. mixer, slips, drags, wheelbarrows.	2-5
Harvey	dirt	Slip work, dragging.	Scraper, drag, maint.	1-4
Jackson	.....	Care rd. bed, except grad.	Shovels, picks, bars, sledge, rd. drag.	2
Mitchell	earth	Grade, fill, etc.	Tractor, graders, Fresnos, slips.	..
Montgomery	.....	Engine grader work.	Tractor, large grader.	4
Neosho	dirt	Clean. grub, clean ditches, etc.	Slips, Fresnos, grader, planer, hand tools.	6
Pawnee	dirt	Grade & surface.	Grader, 5 Fresnos, plow, roller, harrow.	12
Republic	on 13 mi.	Drag & grade.	2 Trucks, 2 heavy drags, grader, slips.	2
Sheridan	dirt	.....	.....	5-8
Sumner	earth	All slip work.	Plows, slips, Fresnos, team.	6-10
Wabaunsee	county	Grade & ditch with rd. graders.	Tractor, grader, scrapers, plow.	3-8
Kentucky:				
Boyle	.....	Patch., ditch., bldg. shoulders.	Truck, team, grader, small tools.	2-10
Daviess	gravel & earth	Grade earth rds., ditch, patch, gravel.	Plows, grader, 6 mules, wagon.	5-10
Hancock	earth	Grade, drain, repair culvts, etc.	Truck, grader, drag, plow, scrapers, picks, shovels.	10
Owen	.....	Resurf. work; broken stone.	Truck; broken stone; roller, etc.	5-10
Shelby	W. B. mac.	Ditch & Patch with stone.	Roller, tractor, grader, 2 trucks, hand tools.	12
Whitley	.....	Clean ditches & move slides.	Tractor, rd. grader.	6-10
Louisiana:				
Allen	gravel	Spread grav., drag rds., clean ditches.	None.	5
Maryland:				
Kent	macadam	Patch. mac. & shoulder work.	Trucks, grader, drags, steam roller, tar pots, small tools.	12-15
Michigan:				
Alger	mac. & earth	Hauling material.	Truck & Tractors.	4
Branch	state	Drag., patch., resurf., plow & ditch.	Truck, grader, drags.	4
Eaton	gravel	Ditch, scarifying.	Tractor, scarifier, small tools.	5-10
Huron	imp. & unimp. rds.	Grade on unimp.; guard rail, culverts, tarring.	Tar kettle, large grader, truck.	3-5
Kalkaska	gravel	Resurfacing.	Horses & wagons, screens, shov.	10
Luce	hard surf.	Scarifying, reshape, surf. treat.	Trucks, trailers. distributor, small tools.	8
Macomb	conc. or bit. surf.	Patch, tar, clean ditches, repair culvts., guard rail, cut weeds.	Tar kettle, truck, tools.	2-10
Mecosta	.....	Stock piles, patches, guard rails, culvts., brush.	Truck, shovels, axes, scythes.	2-4
Oakland	conc. & asph.	Patch, tar, cut. weeds, etc.	Truck, tar kettle, heat. furnace, mowing mach. small tools.	6
Ontonagon	.....	Heavy wk., resurf., etc.	Grader, truck, misc. equip.	6-12
Minnesota				
Aitkin		Clear, raising grade	Blade grade & planer	8
Cottonwood	dirt	Reshape w. graders	2 graders, tractor	4
Crow Wing	earth	Reshaping	Grader	5
Faribault	earth	Drags, clean ditches, culverts, bridge repairs	Tractor, drags, blade grader, small tools	...
Goodhue	.....	Reshaping rds.	40-60 tractor, blade grader	...
Hubbard	.....	Reshaping rds.	Tractor, large blade grader	3-4
Isanti	gravel & earth	Regravel small jobs, small fills	.....	...
Lake	state rds.	Gen. repairs	1-2 motor trucks, small tools	2-6
Lincoln	.....	Light regraveling & grading	Wagons & equip., blade, wheelers	4-12
Lyon	gravel	Resurf. by contract	Trucks and loading equip.	...
Martin	gravel & dirt	Light blading, gravel resurf.	Lt. tractor & blade or lt. truck	2
Meeker	gravel	Resurf. & widen	Gravel wagons, fresno & slips	4-40
Murray	.....	Regravel & reshape	Trucks—Tractor & blade grader w. back sloper	...
Norman	.....	Heavy reshaping	35-70 tractor and grader	3
Ottertail	floating gang	Gravel & clay resurf. & widen grade	7 trucks, loading devices, 6 scrapers	16
Redwood	gravel	Reshape & regravel	Caterpillar tractor, blade grader, 3 trucks	3-4
Rice	.....	Regravel	8 trucks	15
Roseau	.....	Heavy reshaping	Large grader	3-4
Stearns	trunk	Grade & surface	Tractor, grader, trucks	10-15
Swift	dirt	Reshaping	40 H. P. tractor, blade, teams, etc.	3
Todd	earth	Heavy reshaping & blade work	Tractor, blade, wagons, slips, wheelers	10
Mississippi				
Noxubee	gravel, sand-clay	Gravel resurf., open ditches, etc.	Rd. mach., scrapers, shovels, trucks	3-10

Gang Maintance—continued

County and State	On What Roads Gang Maintenance is used	Kind of Work Done	Standard Equipment	Number of men in a gang
Missouri				
Butler	county	Gen. rd. & bridge repairs	.....	...
Mississippi	all	Gen. rd. & bridge repairs	.....	3-10
Ralls	mostly all earth	Shape, ditch, smooth	Tractor, grader, plows	4
Washington	.....	Gravel, open ditch, gen. repair	Truck, small tools	2
Montana				
Granite	earth	Patching & bridge repair	None	...
Musselshell	dirt	Emergency	.....	...
Nebraska				
Morrill	dirt & gravel	.....	Truck maint. & drags	2
New Jersey				
Sussex	W. B. mac.	Rebuild worn-out stretches	Trucks, roller w. scarifier, scraper, wagons, small tools	18
Union	all but mac.	Repair	Trucks, steam rollers, tractors	3-10
New York				
Cayuga	state	Clean shoulders, repair depressions, resurf.	Truck, oil heater, minor tools	3 up
Chautauqua	concrete	Patch	Truck, small tools	2
Niagara	all	Clean ditches, repair shoulders, patch, oil	Trucks, roller, 2 heaters, sweeper, oiler, 6 brooms	6-20
Oswego	state	Reconst., heavy drainage	Trucks, asph. heaters, graders, tractors, small tools	5-15
Schenectady	state	Surf. maint.	Motor truck, asph. heater, tools	3-8
Tompkins	earth	Repairs	Cold patch outfit	8
Yates	bituminous	Fill depressions, asph. surf. treat.	Cold patch & mixing method	4-12
North Carolina				
Bertie	soil	.....	Rd. mach. carts, tractors, trucks, wagons, small tools	6
Forsyth	soil & tarvia pen.	all kinds	.....	..
Graham	dirt	Put in culvts., stone & gravel	Tractor, scrapers, drags	6
Washington	all	Drag, grade, drain, brush	Graders, maintainers, drags	6-15
Wilson	top soil	New const.	Mules, scrapers, drags, picks, shovels	25
North Dakota				
Hettinger	common clay	.....	Trucks, drags, fresnos	3
Ward	earth (not grad.)	Grade worst places	14-20 horses and fresnos, blade and engine	3-8
Ohio				
Ashland	entire co.	Repairs	Truck, conc. mixer, shovels, picks	6
Ashtabula	all impr. rds.	Ditch, cut weeds & brush, repair surf.	Truck, grader, wheelbar., shovels	5
Fairfield	50 mi.	Everything but bridge work	6 trucks, graders, etc.	..
Fulton	co. & state	Repair surf. & reconst.	Steam roller, trucks, graders	..
Hancock	macadam	Grade, reshape & roll	Roller, scarifier, scraper	3
Hardin	state	Repair surf. & drains	.....	3-5
Holmes	state & co.	Patch, reshape & grade	Maint., teams, plows, shovels, scrapers	4-10
Meigs	.....	.....	Road maint.	8
Mercer	state	Repair surf. cracks & joints, ditch	Truck, tar kettle, tools	5-6
Ottawa	.....	.....	Brooms, truck, tar kettle	4
Pickaway	gravel	Shovel gravel, patch holes, clean ditches	Grader, 2 drags, shovels, rakes, screens, tar kettle	5
Pike	state	Repair & drag	Truck, drag, tools	8
Putnam	W. B. mac.	Patch with tar & stone	Truck, shovels	6
Sandusky	state	Patch, bitum. rds., repair conc.	Auto, trucks, conc. mixer, mower, grader	4-10
Shelby	.....	Drag, scrape, cut side ditches, haul materials	Drags, scrapers, trucks, teams	4-35
Williams	mac. & bit. mac.	Patch, haul materials, ditch, spread covering	4 Nash quads, truck, sweeper, grad., picks, shovels, brooms, etc.	8-25
Oklahoma				
Carter	gravel	Main. & repair. rd. bed & surf.	Trucks, grader, etc.	2-10
Ellis	dirt	Regrade	Grader, 12 mules, 3 fresnos	7
Grady	county	Repair work	None	..
Major	repair	Bridge & culvt., repair, grading	4 mules, fresno, plow, 6 shovels, wagon, grader	4
Oregon				
Grant	dirt	Repairs on washouts, grade & smooth. with graders	Roller, plow, grader, 3 fresnos, 2 slips, wagon	4-12
Pennsylvania				
Delaware	tarvia	Repair & rebuilding	Picks, shovels, drills, etc.	15-20
Erie	dirt	Grade & gravel	.....	3-8
Jefferson	dirt	Surf. & ditching	Picks, shovels, scraper, teams	6-8
Lackawanna	asph. conc.	Repair small surf. breaks	Asph. tank & stone truck	6
Monroe	dirt & shale	Open ditches & repair rd.	Rd. mach., drags, hand tools	..
Warren	all	Gen. repairs conc. & grad. earth	Varies	..
South Carolina				
Aiken	sand-clay	.....	Truck, rd. mach.	6
Anderson	top soil	Machining up rds.	Tractors, rd. machinery	7-10
Cherokee	mac. top soil	Resurf., repair, etc.	Mach. or graders, scrapers, trucks, tractors, mules	4-8
Greenwood	.....	Scarifiying, heavy mach. resurf.	Tractor, clectrac, 4 rd. mach., 2 scarifiers, plows, small tools	10
South Dakota:				
Clay	dirt	Drag & repair	Tractor, drag, maint.	2
Custer	dirt & gravel	Remodel crowns, widen curves	Grader & 4 horses, plow, fresno	3
Day	.....	Repairs holes & washouts	Truck, small tools	4
Douglas	dirt	Fill holes, etc.	Plow, scrapers, drag	2-6
Gregory	in spring	Maint. with engines and blades	Holt, 3 blades, maint.	2-5
Haakon	.....	.....	Engine, maint.	2
Meade	bridge	Place cul., grade bad washouts	fresno, plow, teams, eng. maint.	2
Miner	clay & gravel	Fill chuck holes, washouts & mow weeds	.....	..
Spink	.....	Gen. maint. & keeping up rd.	Engine, blade grader, rd. finisher, small tools	2
Tennessee:				
Bradley	gravel & rock	Grade, roll, haul gravel, etc.	Roller, 6 graders, steam engine, 2 tractors	8
Cocke	pike	Scatter crushed rock	Crusher outfit, wagons, teams	10
Cumberland	.....	General repairs	.....	..
Grundy	earth	Drag & drain	Hand tools & drag	10
Hamilton	all near camp	Ditch & repairs to surf.	Truck, asph. kettle, picks, shovels	7
Hawkins	graded rd.	General repair work	Tractor, grader, trucks, slips, etc.	5
Jefferson	mac.	Crush rock, fill holes, open ditches	Rock crusher, trucks, steam drill, etc.	20
Lewis	grad & chert surf.	.....	Truck grader, small tools	4
Montgomery	.....	Haul gravel & stone	Trucks	3-5
Rutherford	federal aid	Look after shoulders & ditches	.....	1

Gang Maintance—continued

County and State	On What Roads Gang Maintenance is used	Kind of Work Done	Standard Equipment	Number of men in a gang
Texas:				
Aransas	.....	Emergency	.....	..
Colorado	.....	Keep bad holes passable	8 mules, 2 wagons, grader, plow, fresno	2
Comanche	.....	Blades shoulders & surf., repair bridges	Tractor, grader, wagon, team, tools	4
Smith	all	Replace shoulder material & keep ditches & should. in shape	4 teams, 2 trucks, portable camps	10
Tarrant	all	General maintenance	Picks, shovels, rakes, trucks	..
Wichita	dirt	Maintenance	Tractor, heavy blade, drags	8
Wise	all	Grade, drag, repair structures & patch gravel rds.	2 graders, drag, mules, fresnos, shovels	1-10
Virginia:				
Augusta	earth & mac.	Surf. treat., patch & gen'l. rep.	Truck, patch. outfit, hand tools, teams, scrapers, drag	..
Fairfax	all	Patch, ditch, resurf.	Truck, wheelbarrow, hand tools, rd. machine, teams, etc.	5-10
Halifax	all	General repair	Rd. mach. & small tools	10-12
Scott	soil	Drag, rd. mach., ditching	Truck, tractor, drag, rd. mach., scrapers, picks, shovels	..
Washington:				
Asotin	.....	Maint. & const. small jobs	Grader, tractor or truck, small tools	..
Grant	earth in spring	Repair washouts	Grader, drag, fresnos, shovels, plow, etc.	4
Grays Harbor	gravel	Drag	Truck, blade grader	2
Island	.....	Grade, drag, gravel, ditch., etc.	Truck tractor, grader, drag	5
Lincoln	gravel & mac.	Resurf. with crushed material	Rock crushers, screens, scraper, trucks, scarifier, graders, drag	10-14
Okanogan	.....	Keep ditches & culvts. open, repair surf., drag	.....	1-6
Pierce	paved & gravel	.....	.....	3-10
San Juan	earth & gravel	Deepen ditches, drag new grav.	Trucks, tractor, graders, drags, small tools	2-3
Snohomish	all	Ditches, shoulder, gravel surf., brush	Power loaders, trucks, scarifiers, tractors, drags, rd. level.	10
Whitman	state rds.	clean ditches, distributes maint.	.....	3-10
West Virginia:				
Brooke	all kinds	Drain, surf., repair, etc.	Truck, tools, grader, tractor, tar kettle	7
Hancock	dist. rds.	Ditch, surf., culvts., etc.	Rd. machine, plows, slip scraper, tools, etc.	3-8
McDowell	.....	Repair dirt roads	Rd. mach., scrapers, drags, etc.	10-15
Mineral	earth & bitum.	Oil bitum., surf., clean ditches	Oiler, rd. mach., truck	3-8
Monongalia	hard surf. rds.	Ditch, burn & tar seams, etc.	Truck, tar kettle	10-15
Polk	.....	Heavy grading, light const.	Tractor, grader, fresnos, plow	6
Wyoming	all	Drag, fill in low places, etc.	Tractor, rd. mach., pick, shovel	4-8
Wisconsin:				
Adams	sand	Haul clay for surf.	Grader, plow & wagons	12
Brown	.....	Mostly widening rds.	Tractor, graders	6-10
Buffalo	all not imprv.	Large grader & fresno scraper	Tractor and grader	2
Fond du Lac	to assist regular patrol	Widen & ditch.	Tractor, large grader, plows & scrapers	..
Forest	earth rds.; spring	Heavy maint., culvts, ditches	Tractor, grader, wheelers, plows	12
Grant	earth & mac.	Oiling & heavy grad.	Tractor, grader, 2 teams with wheel scrapers	6
Jefferson	state & co. trunk lines	Grading; some surf.	Tractor, grader, scarifier	2
Juneau	clay & sand	Grading	Slushers, wheelers	8
La Crosse	dirt	Grading & cutting ditches	Tractor, grader, wheeler, air compressor, tools	6
Lincoln	earth	Regrading	Tractor, grader, 3 teams	5
Monroe	gen. work	Grading	Tractors, graders	8
Price	state trunk line	Regrading & graveling	Graders, teams & wagons	10
Sawyer	.....	Widen & ditch fill	Tractors, graders, teams, wheeler fresno, slips	10
Vernon	earth	Heavy grading	Tractor, grader, scrapers, small tools	4-12
Walworth	.....	Gravel grading, ditching	Trucks, grader, wheelers, plow, etc.	12
Waukesha	dirt	Grade & surf. with crushed grav.	Tractor, grader, port. crushing plant, trucks	10-15
Winnebago	gravel & mac.	Scarify & level	Gas. roller & combined scarifier & grader	2

Cost of Maintenance

County and State	Mileage Under Maintenance	Amount spent for maintenance in 1921	Amount available for maintenance in 1922
Alabama:			
Etowah	1,100 unimp., grad., gravel, chert, surf. treat.	$43,829	$40,000
Montgomery	450	200,000	200,000
Arkansas:			
Hempstead	64 gravel.	6,600	7,500
California:			
Fresno	60 paved and 100 mt.	20,000	100,000
Plumas	500	60,000	90,000
Sacramento	130 conc., 100 asph. mac., 1,600 dirt.	200,000	200,000
Sutter	8.5 con., 40 oil mac.	3,000	60,000
Colorado:			
Elbert	.....	.....	20,000
Lake	64.5 gravel.	8,000	10,000
Lincoln	Scattered.	.....	22,000
Logan	800 co. and state.	20,000	20,000
Delaware:			
New Castle	962 various.	363,000	.....
Idaho:			
Clark	Not classified.	10,000	10,000
Power	52 gravel, 148 earth.	17,000	15,000
Shoshone	60 regular and 60 part time.	53,500	30,000
Illinois:			
Bond	None.	.....	20,000
Christian	27	3,100	5,000
De Witt	None.	.....	38,000
Fulton	150	18,000	70,000
Iroquois	None.	.....	43,000
Johnson	By arrangement with rd. com.	30,000	44,000
Knox	160 oiled rds.		
Lee	53 stone or gravel, 107 earth.	150,000	70,000
		18,000	75,000

Cost of Maintenance (Continued)

County and State	Mileage Under Maintenance	Amount spent for maintenance in 1921	Amount available for maintenance in 1922
Illinois (Continued):			
Logan	94	10,000	15,000
Marion	15 earth.	1,200	3,700
McDonough	500	100*	150*
McHenry	.....	191,000	44,000
Monroe	None.	None	10,000
Pope	None.	.....	1,000†
Pratt	200 oiled.	15,000	20,000
Pulaski	30, mostly gravel.	3,000	8,500
Scott	None	.....	58,482
Stephenson	5 state rds.	.....	160,000
Williamson	.....	77,850	80,000
Winnebago	8	1,073	1,472
Woodford	30 oiled earth.	13,000	50,000
Indiana:			
Decatur	400 macadam.	100,000	100,000
Dubois	95	14,500	15,000
Hancock	500 all types.	50,000	40,000
Henry	385 gravel.	78,000	80,000
Jackson	550	55,000	70,000
Jasper	300 stone and gravel.	47,000	50,000
Jennings	280 gravel and stone.	28,000	40,000
Madison	1,000, 50 surf.	100,000	130,000
Morgan	400 gravel and crushed stone.	25,000	28,000
Posey	325 gravel.	80,000	63,000
Shelby	420 gravel, stone, conc.	70,000	70,000
St. Joseph	117⅝ gravel, 30⅝ conc., 5¾ asph. mac.	90,000	85,000
Vermillion	15 hard rds., 405 gravel.	65,600	71,000
Vigo	525 gravel, stone, brk., asph. and conc.	175,000	50,000
Wayne	450	50,000	50,000
Iowa:			
Adair	60 earth.	14,000	16,000
Allamahee	85 earth by state, 95 by county.	64,000	58,000
Benton	242 county and prim.	80,000	74,000
Black Hawk	185 earth, incl. 15 gravel.	64,000	57,000
Boone	185	36,000	40,000
Bremer	130	37,000	34,000
Buena Vista	158 gravel, 17 earth.	60,000	50,000
Cass	160 dirt.	40,000	50,000
Cerro Gordo	36 conc. 125 earth.	28,000	35,000
Chickasaw	146	39,000	40,000
Clark	12.6 earth.	39,000	36,000
Clay	34 earth, 121 gravel, 27 resurf.	36,900	40,000
Clinton	190 earth and gravel.	42,000	60,000
Crawford	158	80,000	60,000
Dallas	92 co., 87 prim., 920 twp.	97,500	100,000
Davis	53 dirt.	6,116	40,000
Decatur	Earth.	44,363	45,000
Dickinson	142 gravel.	50,000	35,000
Dubuque	40 gravel, 3.5 pav., 130 earth.	60,000	60,000
Floyd	Gravel $185 per mi.	34,578	25,000
Guthrie	200 earth.	50,000	50,000
Hamilton	125 gravel, 125 earth.	45,000	40,000
Hancock	10 pav., 30 gravel, 110 dirt.	20,000	20,000
Harrison	170 earth.	300*	50,000
Jackson	162 earth.	35,000	40,000
Jasper	225 earth and gravel.	62,000	62,000
Kossuth	180	60,000	60,000
Linn	100 prim., 112 county.	80,000	80,000
Lyon	31 gravel, 157 earth.	20,000	25,000
Marshall	61 pav., 12 gravel, 182 dirt.	45,000	36,000
Mitchell	16 gravel, 45 earth to grade, 80 temp.	40,000	55,000
Monona	165 earth.	33,929	37,000
Montgomery	150 dirt.	50,000	50,000
Muscatine	41 conc., 4.15 gravel, 151.5 earth.	36,271	84,000
Palo Alto	2 pav., 12 gravel, 102 earth.	21,300	20,000
Pocahontas	141 gravel, 36 earth.	50,589	65,000
Pottawattomie.	302	70,000	125,000
Ringgold	200	40,000	30,000
Sac	110 gravel, 40 graded earth.	62,000	60,000
Scott	17 brk. pav., 30 mac., 115 dirt.	36,658	53,000
Shelby	153.6 earth.	63,641	Same
Story	100 earth, 100 gravel.	90,000	35,000
Union	154 earth.	28,000	Same
Wapello	150 dirt.	34,000	50,000
Warren	178 earth.	44,383	50,000
Wayne	180	25,000	50,000
Webster	55 gravel, 132 earth.	71,600	60,000
Worth	116	21,700	28,000
Kansas:			
Anderson	149 earth.	6,228	7,000
Barton	3 conc., 230 dirt (co.), 560 (twn.).	20,154	25,000
Bourbon	45 W. B., 13 W. B. and bitum. surf.	.....	.....
Butler	240 dirt.	70,000	75,000
Clay	190 dirt.	27,800	26,000
Cloud	202 dirt.	7,813	14,000
Doniphan	532 earth.	76,373	.....

County and State	Mileage Under Maintenance	Amount spent for maintenance in 1921	Amount available for maintenance in 1922
Kansas (Continued):			
Finney	300 earth.	7,500	9,000
Geary	2.5 brk., 8 conc., 95.75 earth co., 44,216 earth twp.	60,802	60,000
Greeley	78 earth.	570	650
Harvey	729 dirt.	81,224	90,000
Jackson	69	7,210	11,250
Kearny	66 co., 40 twp.	2,733	10,000
Mitchell	212 earth.	26,402	23,000
Montgomery	Each and gravel.	40,000	42,000
Neosho	.....	.....	8,500
Pawnee	139 dirt, 2 gravel, 3 sand-clay.	7,856	12,365
Republic	206 earth.	12,000	12,000
Sheridan	175	5,000	5,000
Sumner	553.4 earth.	29,455	.....
Wabaunsee	180 dirt.	12,000	12,000
Wichita	68 dirt.	672	800
Kentucky:			
Hancock	400 earth, 10 gravel.	16,000	16,000
Henderson	555 earth, 95½ gravel.	54,450	75,000
Owen	.....	.....	25,000
Rockcastle	4 macadam.	2,500	6,000
Shelby	480	71,000	5,000
Whitley	65	5,200	3,200
Louisiana:			
Allen		....	50,000
Maryland:			
Kent	20 cem., 10 mac., 10 grav.	....	270,000
Michigan:			
Alger	40 mac., 80 earth.	61,204	65,000
Branch	47 conc. & gravel, state, 150 gravel, co.	30,688	30,000
Eaton	200	90,594	70,000
Huron	10 conc., 230 gravel.	85,000	70,000
Kalkaska	55	10,500	10,000
Luce	50 hard surf., 20 dirt	18,000	35,000
Macomb	226 gravel, slag grav., conc., asph. conc.	105,000	100,000
Mecosta	126 gravel.	26,000	26,000
Oakland	290 gravel, 70 conc.	282,487	300,000
Ontonagon	150	51,000	56,000
Minnesota:			
Aitkin	189 dirt & gravel	....	20,000
Blue Earth	150 gravel & earth.	39,220	40,000
Chippewa	67 gravel & dirt	12,023	12,000
Clay	108 earth & gravel.	27,224	25,000
Cottonwood	Gravel and dirt.	32,000	12,000
Crow Wing	92.7 trunk hwy., 82.5 state, 154 co.	20,246	19,050
Dakota	257.8 dirt & gravel	31,924	Same
Dodge	60 dirt & gravel	13,515	12,000
Faribault	.....	17,000	35,000
Goodhue	130	50,000	50,000
Grant	50 earth, 20 gravel	10,212	10,000
Hubbard	146	20,000	20,000
Isanti	80, 40 grav., surf.	8,788	10,000
Jackson	35 gravel, 3 dirt.	23,000	18,000
Kandiyohi	50	5,000	10,000
Lake	85 state & co.	6,495	6,000
Lincoln	30 dirt, 30 gravel.	5,618	6,000
Lyon	177.6 to June 1.	19,029	25,000
Martin	28 gravel, 108 dirt.	30,873	30,000
Meeker	200 gravel	60,000	50,000
Murray	50 dirt, 25 gravel; 34 gravel by state	20,713	20,000
Nobles	160 earth & gravel	23,475	35,000
Norman	150	42,000	50,000
Ottertail	450 dirt & grav. surf.	75,000	Same
Pope	150	....	10,000
Redwood	130 grav., 8 dirt.	58,000	45,000
Rice	290.8 state, 70.68 trunk hwy.; 13 pav., rest grav.	30,245	Same
Roseau	180 earth & grav., surf.	18,000	Same
Stearns	364	70,000	70,000
Swift	22 gravel, 51 dirt	28,000	25,000
Todd	165 petrol. & grader maint.	25,600	31,000
Washington	40 gravel, 46 dirt	22,000	20,000
Watonwan	20 gravel, 76 dirt	12,000	12,000
Missouri:			
Butler	600	20,000	20,000
Cooper	.....	....	50,000
Jasper	.....	6,500	8,000
Linn	1000	20,000	Same
Mississippi	500 earth.	20,000	25,000
Rolls	50 earth.	4,000	5,000
Stoddard	.....	20,000	30,000
Washington	.....	2,000	....
Montana:			
Custer	419.60 gravel & dirt graded rds., 429 dirt, $20,000	5,000	46,000
Deer Lodge	300	51,650	None
Granite	200	12,000	10,000
Mussel Shell	1103.1 dirt.	33,500	25,000
Prairie	240	2,200	as need'd

Cost of Maintenance (Continued)

County and State	Mileage Under Maintenance	Amount spent for maintenance in 1921	Amount available for maintenance in 1922
Montana (Continued)			
Richland	1296—212 graded, 100 maint. w. drags.	6,655	5,000
Sheridan	90 earth	3,500	4,000
Valley	250 grad. dirt.	15,600	12,500
Nebraska:			
Knox	65 earth	30,000	40,000
Morrill	40	2,000	2,000
New Jersey:			
Salem	100	40,000	50,000
Sussex	45 W. B. mac., 15 grav.	96,000	100,000
Union	68—80% conc. or other hard surf.	175,000	175,000
New York:			
Cayuga	69 oil & stone chips, 1¼ resurf.	50,000	45,000
Chautauqua	180 mac. & conc.	120,000	120,000
Niagara	450 mac. oiled & patched conc. & brk. cracks poured, shoulders	200,000	200,000
Oswego	State 160, co., 140	135,000	140,000
Schenectady	90	....	94,000
Tompkins	131	130,000	....
Yates	50	53,000	50,000
No. Carolina:			
Bertie	500	45,000	Same
Forsyth	30 hard surf., 170 top soil	15,000	25,000
Graham	114 dirt	22,000	15,000
Washington	175	50,000	25,000
Wilson	20 old mac., 480 gravel & top soil	25,000	25,000
Yancey	200	30,000	....
No. Dakota:			
Barnes	120 dirt.	10,500	15,000
Cass	300 earth, 5 gravel.	30,000	30,000
Grand Forks	140 dirt & gravel.	7,434	17,072
Grant	300	5,000	5,000
Hettinger	200-300	4,000	6,000
Ward	200	20,000	20,000
Williams	200 earth	....	....
Ohio:			
Ashland	Brick, mac., gravel.	90,000	90,000
Ashtabula	25 conc., 25 cinder, 60 bit. mac., 65 brk.	105,000	145,000
Fairfield	220	120,000	150,000
Fulton	37.27 state, 226.48 co.	91,000* / 109,000‡	55,000 / 75,100
Hancock	50 hard surf., 150 mac.	250,000	200,000
Hardin	All.	....	....
Holmes	None.	....	40,000† / 10,000*
Logan	840 gravel & stone.	255,000	146,000
Meigs	Conc., mac., brk.	7,500	9,000
Mercer	22 mac. & conc.	3,000	....
Ottawa	30 macadam.	30,000	18,000
Pickaway	23 gravel, 20 tar, 4 conc.	....	....
Pike	1100	....	36,000
Putnam	35 W. B. macadam.	38,000	150,000
Sandusky	75 state, 25 co.	50,000* / 30,000†	45,000* / 23,000†
Shelby	868 gravel, dirt, mac., tar, conc.	167,000	175,000
Williams	80 mac., 10 conc.	50,000	30,000
Oklahoma:			
Carter	300 gravel & dirt.	50,000	75,000
Ellis	115 dirt & sand clay.	6,000	8,000
Garfield	303 dirt.	39,906	8,200§
Grady	237½ state, 1400 twp. rds.	25,000	40,000
Jackson	190	7,500	10,000
Major	278	12,899	Same
Oregon:			
Grant	850	20,000	23,000
Pennsylvania			
Delaware	72 tarvia.	40,000	75,000
Jefferson	100	....	....
Lackawanna	21 asph. conc.	100,000	100,000
Monroe	70—1000 in dists.	80,000¶ / 18,000*	15,000
Warren	25 conc. & mac.	5,000	....
So. Carolina:			
Aiken	69.8	15,000	20,000
Anderson	Ave. cost of maint. $1300 per mi.	....	60,000
Cherokee	63 top soil, 8 clay stone.	281,000	....
Chesterfield	18 gravel	2,400	3,000
Greenwood	2.02 conc., 111.4 top soil, 1.6 earth.	31,604	32,000
So. Dakota:			
Clay	192	20,753	16,000
Codington	11 gravel, 250 earth	15,701	16,000
Custer	Park work.	6,000	10,000
Day	28 dragging.	16,000	16,000
Douglas	247 dirt.	8,943	9,057
Faulk	220 dirt.	7,000	8,000
Gregory	200 earth.	15,000	12,000
Haakon	200 dirt.	5,000	4,000
Hanson	256	8,500	10,000
Jackson	200 dirt.	4,000	4,000
McCook	Some farm dragging on dirt rds.	8,000	10,000
Meade	550 dirt.	25,000	16,000
Miner	.....	6,000	6,000
Roberts	450	22,300	....
Spink	.....	25,000	25,000
Sully	120 earth.	2,000	3,000
Yankton	220 earth.	28,500	30,000
Tennessee:			
Bradley	353 dirt & gravel.	7,000	8,000
Claiborne	50	3,000	5,000
Cocke	100 W. B. macadam.	25,000	25,000
Grundy	40 earth.	5,000	9,000
Hamilton	600	100,000	100,000
Hawkins	320	5,200	8,000
Jefferson	200	17,000	17,000
Lewis	24 dirt.	2,000	5,000
Montgomery	30	12,000	10,000
White	5.15 clay, 40 W. B. mac.	37,450	40,000
Texas:			
Aransas	87 shell	....	15,000
Colorado	36 gravel, 200 dirt.	25,500	26,000
Comanche	206 graded.	21,632	51,478
Johnson	100 dirt, 100 gravel.	60,000	75,000
Madison	None	....	4,000
Newton	40	....	....
Smith	Gravel, earth.	50,800	50,000
Tarrant	150 pav., 660 grav., 198 sand-clay, 35 dirt.	....	....
Wichita	576 total, 37 conc.	....	....
Wise	30 shell gravel, 30 sand-clay, 20 earth or sand	10,000	11,000
Virginia:			
Augusta	200 mac., 900 earth.	75,000	75,000
Fairfax	10 W. B. mac., surf. treated, 26 gravel.	15,000	15,000
Halifax	100 soil	15,000	18,000
Scott	200	25,000	30,000
Washington:			
Asotin	20 crushed rock, 25 gravel, 300 earth	30,000	33,000
Callam	90 gravel	46,000	47,000
Douglas	61 surf. hwys.	27,000	31,000
Grant	200 gravel surf.	55,000	60,000
Grays Harbor	30 conc., 3 asph., 300 gravel	120,000	100,000
Island	225 dirt & gravel	30,000	25,000
Jefferson	170 gravel	28,656	Same
Lewis	900	285,083 Co. / 51,412 St.	293,148 / 46,482
Lincoln	210 gravel & mac.	61,000	61,000
Okanogan	60	26,000	25,000
Pierce	96 paved & gravel	68,000	69,000
San Juan	140 earth & gravel	16,189	16,500
Snohomish	140 conc., 360 gravel	200,700	160,000
Whitman	106 crushed rock	104,000	104,000
W. Virginia:			
Braxton	650 earth	13,000	20,000
Brooke	54 impr., 126 unimpr.	153,693	90,000
Hancock	33.52 brk., 8.72 conc., 140 earth, 2.7 others	25,000	34,000
Mason	850	....	....
McDowell	200; 50 conc. & asph. Ky.	50,000	50,000
Mineral	18 bitum., 100 earth	35,000	35,000
Monongalia	30 impr., 1,000 unimpr.	100,000	49,000
Polk	325 gravel & dirt	75,000	50,000
Upshur	745¼ dirt, 4¾ dirt	12,000	14,000
Wyoming	500	100,000	110,000
Wisconsin:			
Adams	96 sand & clay, 2 mac.	16,000	19,000
Brown	400 gravel & mac.	106,000	100,000
Buffalo	200	30,000	....
Fond du Lac	12 conc., 408 dirt & gravel	94,799	80,000
Forest	60	32,500	52,000
Grant	475 earth, gravel & mac.	101,469	99,000
Jefferson	200	67,000	74,000
Juneau	220 clay & sand	40,000	35,000
La Crosse	146	36,893	35,045
Lincoln	215 earth & gravel	39,421	50,000
Monroe	425 sand & clay	57,000	74,000
Price	25	24,000	32,000
Sawyer	265 dirt	29,000	35,000
Vernon	400	112,299	92,000
Walworth	278.5 conc., grav., mac.	113,530	94,000
Waukesha	15	9,000	....
Winnebago	165 all kinds	12,000	Same
Wyoming:			
Weston	30 earth	12,000	same

*County.
†State.
‡State to County.
§To July 1.
¶Districts.

NEWS OF THE SOCIETIES

CALENDAR

Apr. 19—NEW YORK SECTION, AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. Enginering Societies Bldg., New York City.

Apr. 19-21—AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. General meeting. Chicago, Ill.

Apr. 19-21 — TRI-STATE WATER AND LIGHT ASSOCIATION OF THE CAROLINAS AND GEORGIA. Spartanburg, S. C.

Apr. 20—NATIONAL FEDERATION OF CONSTRUCTION INDUSTRIES. Meeting called by committee of organization at Hotel Commodore, New York. General secretary, W. S. Hays, Drexel Building, Philadelphia.

Apr. 25-28—BUILDING OFFICIALS' CONFERENCE. Annual meeting. Hotel Lincoln, Indianapolis, Ind.

Apr. 26-28—SOCIETY OF INDUSTRIAL ENGINEERS. National spring convention. Detroit, Mich.

Apr. 27-29—BUILDING OFFICIALS' CONFERENCE. April 27-28, Clevland, O.; April 28, Massillon, O.; April 30, Youngstown, O.

Apr. 29—DETROIT ENGINEERING SOCIETY. Hotel Cadillac, Detroit, Mich.

May 8-12—AMERICAN SOCIETY OF MECHANICAL ENGINEERS. Atlanta, Georgia.

May 9-11—NATIONAL FIRE PROTECTION ASSOCIATION. Annual meeting. Atlantic City, N. J.

May 12 — NATIONAL HIGHWAY TRAFFIC ASSOCIATION. Annual meeting. Automobile Club of America, New York City.

May 15-19 — AMERICAN WATER WORKS ASSOCIATION. 42d annual convention. Bellevue-Stratford Hotel, Philadelphia. Secretary, J. M. Diven, 153 W. 71st St., New York.

May 15-19 — NATIONAL ELECTRIC LIGHT ASSOCIATION. Annual convention. Atlantic City, N. J.

May 16-18 — CHAMBER OF COMMERCE OF U. S. A. 10th annual meeting. Washington, D. C.

June 4-6—AMERICAN ASSOCIATION OF ENGINEERS. 8th annual convention. Salt Lake City, Utah.

June 7 — NORTHWEST SECTION, NATIONAL ELECTRIC LIGHT AND POWER ASSOCIATION. Boise, Ida.

June 13-16 — CANADIAN GOOD ROADS ASSOCIATION. Annual convention. Victoria, B. C.

June 19-22—AMERICAN INSTITUTE OF CHEMICAL ENGINEERS. Summer meeting. Clifton Hotel, Niagara Falls.

June 21-22—AMERICAN SOCIETY OF CIVIL ENGINEERS. Annual convention. Portsmouth, N. H.

June 26-30—AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. Annual convention. Niagara Falls, Ont.

June 26-July 1 — AMERICAN SOCIETY FOR TESTING MATERIALS. 25th annual meeting. Chalfonte-Hadden Hall Hotel, Atlantic City, N. J.

Aug. 28-Sept. 2—NATIONAL SAFETY CONGRESS. Detroit, Mich.

Sept. 11-15—ASSOCIATION OF IRON AND STEEL ELECTRICAL ENGINEERS. New Auditorium, Cleveland, Ohio.

Sept. 25-28—SOUTHWEST WATER WORKS ASSOCIATION. Annual convention. Hot Springs, Ark.

Oct. 9-13—AMERICAN SOCIETY FOR MUNICIPAL IMPROVEMENTS. Annual convention. Clevland, Ohio.

Oct. 16-19 — AMERICAN PUBLIC HEALTH ASSOCIATION. Annual meeting. Cleveland, Ohio.

Nov. 15-16—NATIONAL INDUSTRIAL LEAGUE. Annual meeting. New York City. Secretary, J. H. Beek, Chicago.

BROOKLYN ENGINEERS' CLUB

An informal smoker and get-to-gether meeting was held April 6, in the club house.

As a specially interesting feature, the club had as its guest of honor Captain Clarence F. Foster, athletic director of the Polytechnic Institute of Brooklyn, who spoke on "Keeping the Business Man Practically Fit."

Refreshments were served.

AMERICAN SOCIETY OF CIVIL ENGINEERS

At the regular business meeting April 5, Gustav Lindenthal presented a paper, illustrated by lantern slides, on "The Continuous Truss Bridge Over the Ohio River at Sciotoville, Ohio, for the Chesapeake and Ohio Northern Railway."

THE SECOND NATIONAL CONFERENCE ON STATE PARKS

The Second National Conference on State Parks, which has been called in the interests of State park development by John Barton Payne, chairman of conference, will be held at the Bear Mountain Inn, Palisades Interstate Park, New York, from May 22 to 25, 1922.

The First National Conference on State Parks was held in Des Moines, Iowa, in January, 1921, for the purpose of stimulating interest in state park systems, especially with a view to future requirements and the acquisition of lands suitable for preserves and reservations in all states, before advancing real estate values, makes such acquisition prohibitive.

In New York State increasing recognition has been given to the value of the Adirondack Forest Preserve, Catskill Forest Preserve, the Palisades Interstate Park, Bronx River Parkway and the recently created Allegany State Park, as the main elements of a state-wide park system.

Considerable thought has also been given to the development of a great outer park system for New York City, the basis of which is the Croton Watershed, 360 square miles in extent, and connected with the city by the Bronx River Parkway, on which construction work is now nearing completion.

The program of the coming Second National Conference on State Parks will include an inspection of the Palisades Interstate Park, the new Storm King Highway, New York Zoological Park and Bronx River Parkway Reservation. Special interest will also be centered in Westchester County on account of three bills just passed by the Legislature and approved by the Governor. One of these bills conveys Mohansic Lake Reservation of 1100 acres of Westchester County for park purposes; another authorizes the establishment of a county park system, which will include extensive beaches on the Hudson River and on the Sound, and the third bill authorizes the Bear Mountain-Peekskill bridge across the Hudson.

AMERICAN WATER WORKS ASSOCIATION CONVENTION TENTATIVE PROGRAM

May 15—Forenoon and afternoon, Group Meetings. Evening, President's Address, Reception and Dance.

May 16—Forenoon, Business Section, Report of Publication Committee, Report of Finance Committee; G. W. Fuller, Philadelphia Water Supply, Present and Proposed; F. C. Jordan, Fire Prevention and Fire Protection in Relation to Public Water Supply. Afternoon, J. Waldo Smith, Development of the Schoharie Watershed, Catskill Water Supply; M. M. O'Shaugnessy, the Hetch Hetchy Water Supply; John H. Gregory, Tentative; Wm. A. Megraw, the Construction of the Loch Raven Dam; G. E. Willcomb, Twenty Years Filtration Practice at Albany; Election of Members for Nominating Committee. Evening, *American Water Works Association Manufacturer's Program.* Moving Pictures Showing 20,000 H.P. of High Pressure Steam Being Discharged to Atmosphere and Shut off in 30 Seconds by Dean Control; Short Paper by Peter Payne Dean; Thomas F. Wolfe, Underground Leakage and its Relation to Mains and Services; John Oliphant, Pneumatic Pumping, Up-to-Date.

May 17—Forenoon, Report of Special Committees, Committee on Standard Forms of Contract; Report of Council on Standardization; Report of Committee on Industrial Wastes in Relation to Water Supply; Report of Committee on Watershed Protection; George R. Taylor, Problems in the Reforestation of Watersheds; Selection of time and place for next meeting. Afternoon, Trip (2.30 to 5.30 o'clock). Evening, J. W. Ledoux, Some Observations Concerning Wood Pipe; Report of Committee on Standard Specifications for Cast Iron Pipe and Specials; C. E. Inman, Experience with Cast Iron Water Pipe for Pressures Higher Than Allowed by Current Specifications; Peter Gillespie, Centrifugally Cast Iron Pipe (with slides); Theatre Party (Ladies).

May 18, Superintendent's Day—Forenoon, L. H. Enslow, Water Chlorination Control in Virginia; Report of Committee on Physical Standards for Distribution Systems; M. M. Borden, Air and Relief Valves; Wm. P. Mason, Instances of the Value of a Sanitary Survey; F. A. McInnes, Causes of Failure of Cast Iron Pipe; Topical Discussion, Breaks in Water Mains; Other Topical Discussions. Afternoon, George E. Cripps, Equipment and Shop Facilities for Maintenance of Water Works Systems; Topical Discussion; W. R. Conard, Present Day Tars for Pipe Coatings; Topical Discussions. Afternoon, *Chemical and Bacteriological Section.* Report of Committee on Standard Methods of Water Analysis; Report of Committee on Colloidal Chemistry in Relation to Water Purification; Report of Committee on Testing Water

(Continued on page 276)

New Appliances

Describing New Machinery, Apparatus, Materials and Methods and Recent Interesting Installations

NEW STEAM SCARIFIER

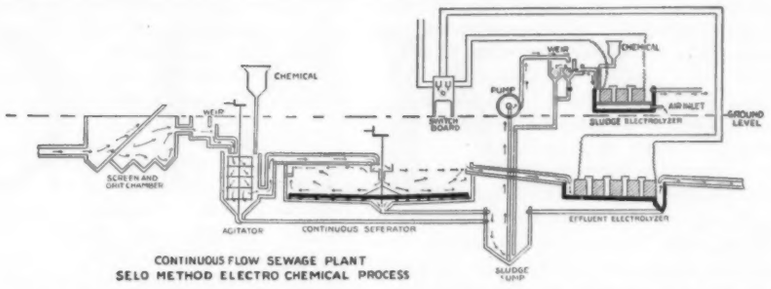
A new Steam Scarifier to be attached to the Case Road Roller, has just been announced by the J. I. Case T. M. Co., who claims that it has several distinctive advantages and features that contribute to its general durability and efficiency.

The roller has ample power to handle the scarifier, operating economy, ruggedness and dependability, flexibility and easy control of outfit, essential to withstand the severe work often encountered. The steam rollers with scarifier attachment have all steel gearing. Spring cushions in the differential gear assembly serve to absorb all sudden strain thrown on the gearing.

The scarifier is attached to the rear of the roller and the same operator handles both. The additional weight of the complete attachment is about 1,850 pounds. A steam pressure cylinder, which is under instant control of the operator, by manipulating a four way valve, is employed to raise and lower the teeth. The teeth are forced into the ground under a steam pressure of 4 tons and are held there by a steam cushion. The picks are quickly raised or lowered in passing over cross walks, manhole covers and other immovable obstacles.

The six 1½ x 2½ x 22-inch scarifier teeth are made of tool steel accurately forged and carefully tempered. The picks are adjustable for depth and gauge wheels prevent them from digging below the required depth in case the rear rolls drop into a hole in the road.

The width of cut can be varied from 40 to 56 inches, depending on the spacing of picks or any picks can be removed.



CONTINUOUS FLOW SEWAGE PLANT
SELO METHOD ELECTRO CHEMICAL PROCESS

ELECTRICALLY CONTROLLED PENETROMETER

After seven years of experimental work an electrically controlled penetrometer has been perfected, for use in testing laboratories, to automatically time penetration tests of plastic substances.

It is manufactured by Howard & Morse and is recommended by them for the elimination of personal equation when testing asphalt, bitumen, tar, rubber and other material, where the unknown factor of human error is claimed to be replaced by clockwork accuracy. The instrument contains a timing device by means of which an electric current, acting through a magnet, releases a bar carrying the penetration needle, allowing penetration to be effected for a given period, at the expiration of which the bar is automatically clamped by the magnet and the depth of penetration measured.

The instrument can be connected to six dry cells or their equivalent or the current may be supplied from 110 volt direct circuit, connecting through a reducer or from 110 volt alternating circuit, connecting through a rectifier.

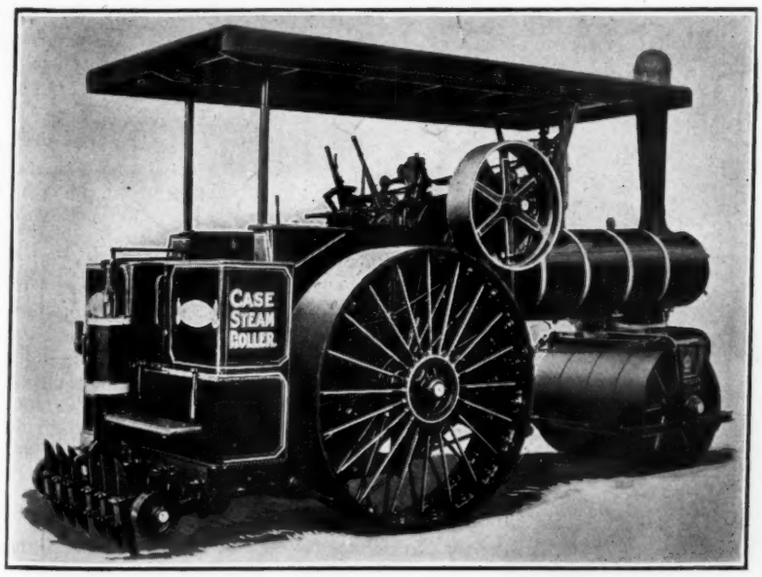
SELO METHOD CHEMICAL SEWAGE DISPOSAL

The continuous flow sewage plant, Selo method of electro chemical process purification, is described in a Monograph issued with compliments of Gelinas Engineering Co., Inc., licensee of the patented Selo method.

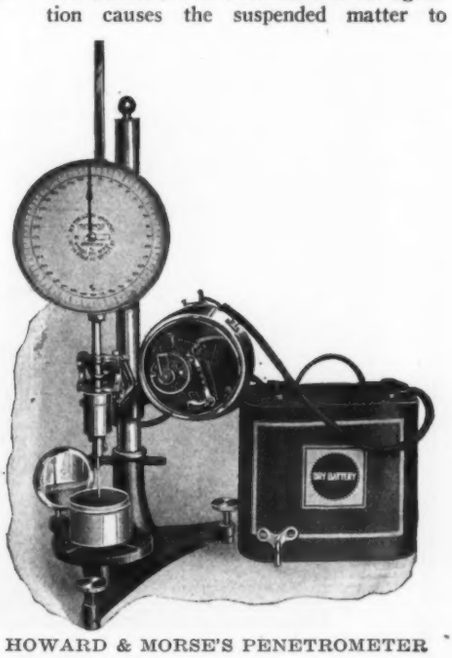
This method, largely automatic in operation, is claimed to produce any desired purification ranging from the separation of the solids to a very complete elimination of germs, according to the varying requirements of the state boards of health, and producing a product of known purity at a fixed price.

This method, which requires only a relatively small acreage, delivers the sewerage, directly from the sewer to a measuring chamber where a float valve operates the automatic control of chemical and electricity in proportion to the varying flow of the sewage.

The sewage then passes to the agitator where it is mixed with a chemical and passes into a large tank, flowing in through the center, and out over the rim. The action of the chemical and the agitation causes the suspended matter to



CASE STEAM ROAD ROLLER WITH SCARIFIER ATTACHMENT



HOWARD & MORSE'S PENETROMETER

gather and settle to the bottom of the tank. The effluent from the latter being clear and sediment which is drawn to a central sump by revolving scrapers.

The sediment sludge passes through an electrolizer where rock salt is added and electric current passed through the mixture while the latter is agitated by compressed air. This treatment kills all germ life present. Afterwards the sludge is run on a sand bed and rapidly drained and dried, and it may be used to great advantage as a fertilizer.

The liquid effluent from the perciptation passes in thin sheets between the electrodes of the electrolizer that liberates oxygen which intensely attacks the organic matter contained in the sewage and virtually burns it up. The electricity also immediately sterilizes all bacterial life. The effluent from the electorlizer is therefore stable as shown by samples kept for months in bottles without developing any odor, while samples of raw sewage taken at the same time became offensive within a day or two. In the clear effluent both the germs and their food have been eliminated and the water can be run into public streams without danger to public health.

The apparatus may be installed anywhere or can be built to accommodate any flow of sewage in towns, cities or in the open country and will not attract or bred insects.

RUSSELL ROAD FINISHER

The new road finisher, made by the Russell Grader Mfg. Co., is notable for its jointed 15-foot blade made with three 5-foot sections and equipped with a cutting edge easily removable for sharpening or replacing. The jointing of the blade provides for setting it to secure any contour that may be desired. It is suspended by a powerful worm gear mechanism from a circle which is reversible, allowing operation on either side of the road. Compensating springs permit the operator to make quick adjustments and the receding platform gives the operator full and unobstructed view of the blade. The machine has a wheel base of 114 inches and a front tread of 53 inches, and rear tread of 93 inches.

The machine is operated by one man. It weighs 3,200 pounds and is designed to be hauled with from 4 to 8 horses or a 12 to 20-h.p. gas tractor. It completely finishes or planes the road from shoulder to shoulder in one round trip.

(*Continued from page 274*)

Works Materials and Supplies, Lime Specifications. Evening, S. T. Powell, Industrial Water Supplies; David A. Decrow, Reciprocating Pumps; S. P. Felix, Turbo-Centrifugal Pumps; Smoker (Men); Card Party (Ladies).

May 19—Forenoon, Joint Session with Chemical and Bacteriological Section. Frank E. Hale, Plant Control of Chlorination by the Excess Chlorine Method as Employed in New York City's Water Supplies; W. W. Brush, Responsibility of the Water Works Superintendent to Prevent Tastes and Odors Due to Microscopic Organisms; W. A. Sperry, Further Notes on Chlorine Control at Grand Rapids; Norman J. Howard, Recent Practice in the Removal of Odors by Aeration, Filtration and Other Processes; Wm. J. Orchard, Recent Developments in Chlorination. Afternoon, Report of Committee on Meter Schedules; T. A. Leisen, Steel Pipe; G. A. Elliott, Steel Pipe; Wm. A. Megraw, Design, Construction and Operation of a Balancing Reservoir. Afternoon, Chemical and Bacteriological Section, Symposium on Tastes and Odors; From Sewage Pollution; H. E. Jordan, the Effect of Wastes from Oil Refineries Upon the Operation of the Filter Plant at East Chicago; From Chlorine Treatment; F. H. Waring, Tastes and Odors from Decomposition and Putrefaction of Organic Material in the Maumee River Water; George C. Bunker and Henry Schuber, Reactions of Culture Media; Norman J. Howard, Chlorination Prior to Filtration, with Special Reference to Efficiency, Economy and Removal of Excess Chlorine; Edward Bartow and G. C. Baker, Water Softening by Base Exchange.

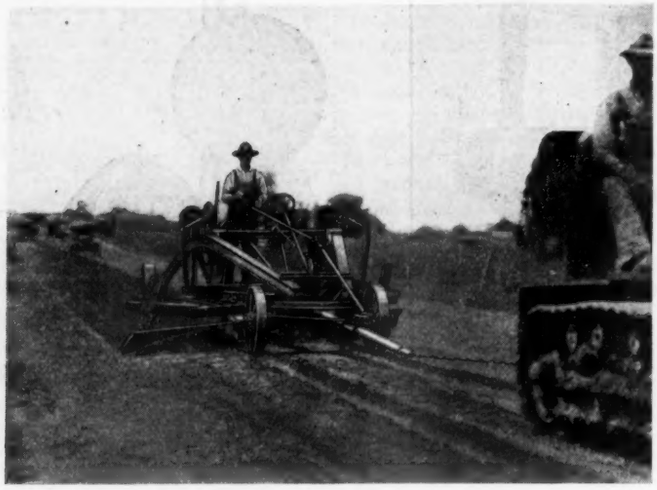
DEPARTMENT OF LABOR AND INDUSTRY, COMMONWEALTH OF PENNSYLVANIA

The largest labor convention ever held in Pennsylvania will be brought to Harrisburg in May of this year. The occasion is the Ninth Annual Convention of Governmental Labor Officials of the United States and Canada to be held May 22 to 26.

Clifford B. Connelley, Pennsylvania Commissioner of Labor and Industry, has invited labor commissioners of the United States and Canada, seventy-five in number, to be present in the hope that a convention of commissioners may be held in connection with the conference. This feature of the conference would have many of the advantages toward unification of administrative policy that were found in the assemblage of governors of the various states in Harrisburg two years ago. The annual meeting of the Department of Labor and Industry will be held at this time. Safety engineers will get together to form a state-wide organization to cooperate with the department.

The tentative program of the governmental Labor Officials Convention includes a child welfare session, inspection, safety and sanitation session, employment, mediation and conciliation, workmen's compensation, medical supervision, and rehabilitation sessions, and a minimum wage and hours session.

In addition to the state officials who are expected to attend the convention there will be large delegation of labor officials representing the Federal Government on problems of nation-wide importance. Not less than one thousand people are expected to be present during the conference.



RUSSELL ROAD FINISHER HAULED BY TRACTOR.

MUSCLE SHOALS

The Committee on Military Affairs of the House of Representatives is about to conclude an exhaustive hearing which has set forth very clearly the many ramifications of the situation surrounding the offers made by Henry Ford, by the Alabama Power Co., and by other interests. A party of 25 or 30 Senators probably will visit Muscle Shoals shortly after the vote is taken on the Four-Power Treaty. Sentiment in Congress in regard to the disposal of government properties at Muscle Shoals is so divided that it seems unlikely that any definite action in the matter will be taken in the near future. Senator Norris has announced that he is preparing a bill, proposing to create a government owned corporation empowered to develop and operate the nitrate and water power projects.